THE UNIVERSITY OF ALBERTA

RELEASE FORM

NAME OF AUTHOR Kofi Marfo

TITLE OF THESIS Evaluation of an Early Intervention Programme for Families with retarded Infants

DEGREE FOR WHICH THESIS WAS PRESENTED Master of Education

YEAR THIS DEGREE GRANTED June 1981

THE UNIVERSITY OF ALBERTA

Evaluation of an Early Intervention Programme for Families with retarded Infants

by

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A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF Master of Education

Educational Psychology

EDMONTON, ALBERTA

FALL, 1981

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled Evaluation of an Early Intervention Programme for Families with retarded Infants submitted by Kofi Marfo in partial fulfilment of the requirements for the degree of Master of Education.

Abstract

The impact of an early intervention programme on five families with Down's syndrome infants and one family with a severely retarded infant of unknown etiology was examined. Mother-infant interaction was coded at an average interval of 4 to 6 weeks over a nine month period, yielding six sets of interaction data. The Bayley Scales of Infant Development and Caldwell's Home Observation for Measurement of the Environment (H.O.M.E.) were administered once before and twice after parent training at approximate intervals of 3 months.

A repeated measures analysis of variance was perfomed separately on mother and infant behaviours. The results showed a significant drop in mothers' attention to infants' physical need and mothers' physical contact with infants. Mothers' physical teaching strategies as reflected in their use of gestures, however, increased over the intervention period. Infants' positive mother-directed behaviours decreased over intervention and were shown to be related to increased mobility and activity with materials. As expected infants' vocalization showed a consistent and dramatic increase over intervention.

Concurrent and lag sequential analyses were used to examine the interactive relationships between pairs of mother and infant behaviours. Increase in the strength of concurrent relationships were demonstrated between: (i)

infants' play activity and mothers' verbal stimulation, (ii) infants' play activity and mothers' stimulation of infants with materials, (iii) infants' positive mother-directed behaviours and mothers' positive emotion, and (iv) infants' positive mother-directed behaviours and mothers' gestures. Analysis of lag 1 data revealed increased responsiveness of mothers in terms of increase in: (i) the dependency of mothers' stimulation of infants with materials on infants' initiation of play activity, and (ii) the dependency of mothers' positive emotion on infants positive mother-directed behaviours. Increase in the responsiveness of infants to their mothers was also demonstrated by increased dependency of infant vocalization and positive mother-directed behaviours on mothers' verbal stimulation.

In relation to infant developmental progress, an index of intervention efficiency showed that relative to normal development infants in the study achieved 78% and 70% growth rates in mental and motor development respectively. In terms of age equivalents subjects showed an average increase of 5.5 months in mental development and 4.8 months in motor development.

A repeated measures analysis of variance on the H.O.M.E. scores showed an overall significant increase in the quality and quantity of social, emotional, and cognitive support available to infants in the home. In relation to specific components of the home environment the highest overall improvements occurred, by order of importance, in:

(i) the provision of appropriate play materials, (ii) maternal involvement with child, and (iii) emotional and verbal responsivity of mother.

The results of the study are cautiously discussed in relation to intervention effects in light of several plausible competing hypotheses.

Acknowledgements

I would like to express my deep appreciation to all persons who have in diverse ways contributed to the preparation of this thesis. I am very grateful to my advisor and colleague, Dr. G. M. Kysela, for his kind permission to use one of his projects for this study and for his guidance and useful suggestions.

I am also thankful to Mrs. Sally Barros for her role in directing the study, and to my friend Michael Nortey for his dedicated assistance in the use of the Textform programme during typing.

For the many useful insights he provided during the preparatory stages and for his objective comments and suggestions on the final draft, I would also like to thank Dr. T.O. Maguire.

Finally, I am grateful to all parents who participated in the study. To them and to their children for whom this study has shown positive intervention results, this thesis is dedicated.

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ONE: INTRODUCTION

The Problem

In the past two decades concerns about the impact of deprived environments on later cognitive functioning have led to the development and implementation of ameliorative programmes for disadvantaged preschoolers. As a result of some degree of positive results demonstrated by these programmes and, secondly, issuing out of the notion of early childhood as a critical period for arresting or correcting developmental problems (Lipton, 1976; Barrera, Routh, Parr, Johnson, Arendshort, Goolsby and Schroeder, 1976; Tjossem, 1976), the target population for early intervention was soon to include handicapped and at-risk children.

While numerous early intervention programmes for handicapped and at-risk infants have sprung up in the last ten to fifteen years, very few of these have been responsive to certain critical variables in intervention programming for this population,namely:

1. locale of intervention
2. age of entry into intervention
3. parent involvement.

That the above variables are crucial to intervention programming has been extensively researched and discussed in relation to programmes for disadvantaged pre-schoolers (Bronfenbrenner, 1974, 1975; Schaefer and Aaronson, 1972; Gordon, 1972; Levenstein, 1972) as well as handicapped and

at-risk infants (Maisto and German, 1979; Karnes and Zehrbach, 1977; Tjossem, 1976; Brinkworth, 1975; Bidder, Bryant and Gray, 1975).

However, mainly because it is more convenient, a good number of current programmes are characteristically centre-based. While most programmes have parent involvement components the extent of involvement is in many cases minimal and may be limited to occasional meetings between para-professionals and parents or among parents to discuss common problems. The home visit component of many programmes is characteristically aimed at taking care of parental and family adjustment problems resulting from the birth of a handicapped child. Some programmes exist which have parent training as their major emphasis (Jeffree, McConkey and Hewson, 1977) but on the whole parents have rarely been trained to assume the position of teachers of their own children.

With regard to age of entry into intervention very few structered intervention programmes provide intervention for infants under two years of age.

A second area of concern is related to procedures usually adopted for the evaluation of intervention effectiveness. While programmes may be specific in nature, the use of rather global measures, notably IQ, in assessing programme effectiveness is a common phenomenon. Especially when intervention begins very early in the infant's life and takes place in the home environment it becomes necessary to

look for intervention effects not only on global child measures, but also on specific behaviour and skill patterns as well as on the quality of the physical and emotional environment. A re-examination of early childhood intervention programmes and their results with regard to cognitive gains has led, recently, to the suggestion that improved social competence, rather than IQ gains, should be the major goal of intervention (Zigler and Trickett, 1978; Zigler and Seitz, 1980). Zigler and Seitz (1980) argue, for example, that improved social competence is a broader goal of intervention because it "includes but is not limited to measured intelligence" (p. 357). Other suggested components of the social competence alternative are measures of physical health and well-being, measures of achievement indicating how well a child is satisfying societal demands, and motivational and emotional attributes.

Statement of the Problem

This study sought to determine the effects of early intervention on families with severely retarded infants and was designed to be responsive to issues currently considered to be crucial in early intervention programming. First, the intervention was planned to begin in the very first year of life. Second, intervention was carried out in the infant's home environment. Third, intervention was implemented with the utmost degree of parent involvement: while a home teacher was sent to each home once a week, the ultimate goal

was to train the parents to become teachers of their own infants. The parent training procedures were highly individualized because intervention was designed to serve individual needs of both infants and mothers.

In relation to evaluation procedures the study was designed to examine the effectiveness of intervention not only in relation to child progress but also to broader changes in the child's total environment. Consequently, the study sought to determine the effects of intervention on: (a) patterns of mother-infant interaction, (b) the generalizability of parent teaching skills, (c) general child developmental progress, and (d) the quality of the infants' physical and emotional environment.

Scope and Limitations of the Study

The study was conducted within the general framework of the Early Education Programme in Edmonton. The study utilized six families with severely retarded infants as subjects. These families were on a waiting list for admission into the home programme for infants aged birth to two and a half years, and their mothers. Because these families were to continue in the Early Education Programme after the termination of this study, the intervention strategy adopted in the study was the same as that employed by the Early Education Programme. After initial assessments to establish the skill levels of the infants, parents were trained to set up instructional goals in the cognitive,

motor, self-help, and language domains, and to teach towards these goals.

The size of the sample as well as the procedure for selection placed some limitation on the degree to which results could be generalized. A second limitation was related to the use of only one group. This made it difficult to attribute results solely to the treatment. Maturation and history were potential sources of internal invalidity in this study.

TWO: REVIEW OF THE LITERATURE

Care and education for the handicapped members of society have passed through a series of historical stages since the primitive and ancient period (Hewett and Forness, 1977). During these several hundred years the provision of services for the handicapped and the nature of such services have been a function of a combination of superstitious and scientific beliefs held about the handicapped. Beginning from a period marked by exploitation, the history of services and care for the handicapped has passed through successive stages marked, respectively, by humane treatment, custodial care, education, and social acceptance (Hewett and Forness, 1977).

The shift from such negative attitudes and practices as infanticide and eugenics - which characterized the period prior to the twentieth century - to the present day very positive practice of early intervention constitutes a dramatic change in the history of care for the handicapped. It also marks the start of a new epoch in the history of education for the handicapped - a period when emphasis is being placed not only on education but also on amelioration of the physical and mental characteristics of the handicapped child as a crucial step toward maximization of future educational outcomes. Consequently the early years of the handicapped child's life have become the focus of

educational and research efforts in the past few years.

The current emphasis on the earliest years of a child's life is justified on a number of grounds. First, the high degree of plasticity as well as the rapidity that characterize the child's early growth and development make it possible to correct or arrest developmental problems, both biological and cultural-environmental (Gordon, Guinagh and Jester, 1977; Tjossem, 1976; Lipton, 1976; Barrera, Routh, Parr, Johnson, Arendshort, Goolsby and Schroeder, 1976; Bloom, 1964). In fact, referring to the early years as the most critical period for the development of intelligence, Bloom (1964) has advocated increased educational input in the first four years of the child's life. Second, it is recognized that early childhood experiences have long-lasting effects which are difficult to alter subsequently and also that early experiences do actually provide the vital basis for what follows later (Pilling and Pringle, 1978). The literature on early experience in animals has also provided additional demonstration of the critical role of the early years of life (Palmer, 1969; Bronfenbrenner, 1968).

Generally the period for early intervention with handicapped children has been defined as the time during a child's development from birth, or as soon as potential handicapping conditions are identified, to approximately five years of age. The critical ages of focus for many early intervention programmes, though, have been 0 to 3 years of

age (Kysela, Marfo and Barros, 1980).

Historical antecedents to intervention with handicapped children

While it may be possible to look for earlier dates for the beginning of efforts at early intervention, a number of studies conducted during the early and middle parts of this century can be seen as paving the way for the present emphasis on early intervention with handicapped and at-risk children. These studies generally reported the efficacy of intervention with slightly older children and involved different categories of children including normal (Jeffrey, 1958), disadvantaged (Bereiter, 1972; Karnes, Teska, Hodgin and Badger, 1970; Gray and Klaus, 1976, 1965; Klaus and Gary, 1968) and retarded children (Skeels 1966; Kirk, 1958; Skeels and Dye, 1939). Jeffrey's (1958) study suggesting that rapid development may be promoted with proper programming and sequencing of learning steps was a significant contribution in this direction. Jeffrey found that it was possible to teach left-right discrimination to 4 year-old children who had previously been unable to learn the discrimination as long as only traditional methods were used.

Two research projects, related to the retarded, "that helped make the transition from the theoretical to the practical "(Caldwell, 1970, p 21) and which shed some light on the prospects of intervention with handicapped children

deserve special mention. The first of these was carried out by Skeels and Dye (1939). Following the rather accidental discovery that two infants transferred from an overcrowed orphanage to an institution for mentally retarded adolescent girls showed a spurt in development after transfer, Skeels and Dye (1939) arranged an experiment in which retarded adolescent girls were used as enrichers for a larger group of 13 babies transferred from the orphanage. The babies had an average age of 19 months and mean IQ of 64. A contrast group of 12 infants with mean age 16.6 months and mean IQ 86.7 remained in the orphanage. After an experimental period of 19 months, the enriched children showed an average IQ gain of 28.5 while the contrast group after an average interval of 30.7 months lost an average of 26.2 IQ points.

To find out whether these striking differences would be maintained over time, Skeels (1966) after almost 30 years, did a follow up study in which it was reported that the two groups had maintained their divergent patterns of competency into adulthood. All the 13 in the experimental group were self supporting with none of them being a ward of any institution. However of the 12 in the contrast group, 1 had died during adolescence in a state institution for the mentally retarded and 4 were still wards of institutions. Other striking differences were found between the two groups in levels of education and occupation as well as in marital status. This study has, in fact, come to be known in certain quarters (Pilling and Pringle, 1978) as the most effective

intervention study ever to be reported.

Kirk's (1958) study is the second historically important study in this area. Kirk compared 28 retarded children living with their families and attending a special nursery school and 15 institutionalized retarded children also attending a special nursery school with 26 retarded children living with their families and 12 living in institutions who did not attend nursery school. After following the children for several years, Kirk (1958) reported that 70 per cent of the children for whom special preschool programmes were available showed IQ increments ranging from 10 to 30 points, although half of the children were classified organically imparied. On the other hand the IQs of the contrast children had declined significantly.

While these studies (Skeels and Dye, 1939; Kirk, 1958; Skeels, 1966) were significant in pointing to the feasibility of intervention with retarded children the single most prominent event that provided immediate impetus for early intervention with handicapped children and set the stage for examining the most critical factors in intervention was the launching, in 1964, of Head Start. The major goal of Head Start was the enhancement of the intellectual development of children. Head Start was itself the child of the U.S. government's official policy, during the 1960s, of "War on Poverty." Stemming from the general realization that children from poor families were ill-equipped to benefit from the educational programmes of

public schools by the time they entered first grade, the policy aimed at improving the opportunities and capabilities of children to benefit from school by offering preschool to all children and particularly the poor in the form of Headstart (Beller, 1979). With the enhancement of the intellectual development of children as a major goal the intervention movement reflected a concern for low levels of intelligence among disadvantaged children. Poverty environments were held responsible for low intellectual functioning. In fact both Ausubel (1966) and Hunt (1964) had indicated that the development of intelligence is a function of the amount and quality of stimulation a child receives. Generally, the belief that intelligence is modifiable and that the environment has a crucial influence on intelligence (Gordon, Guinagh and Jester, 1977) was at the root of most programmes. Hunt's (1964) assertion that intelligence is not fixed, as well as Almy's (1964) position that the development of a child's cognitive abilities requires exposure to a wide variety of stimuli, provided additional impetus to the early intervention movement.

Characteristics of intervention programmes for disadvantaged children

The numerous intervention programmes for the disadvantaged that sprang up as a result of the intervention movement varied not only in intensity but also in form and approach. Intervention periods ranged from a few months to a

few years (Karnes, Zehrbach and Teska, 1971). Similarly programmes varied with respect to whether focus was on the child, the mother, or both. Some programmes focused on the disadvantaged child and did nothing to involve parents (Hodges, McCandles, and Spicker, 1967). There were also programmes which while focusing mainly on the child provided a small amount of parent involvement in the form of visits by social workers to the child's family or occasional parents' meetings (Weikart, 1967, 1970; Schaefer, 1968, 1972; Schaefer and Aaronson, 1972;). In the third category of programmes the focus on the child went alongside active parent involvement of varying kinds (Klaus and Gray, 1968; Gray and Klaus, 1970; Levenstein, 1970, 1972; Beller, 1972). The fourth category of programmes were those that had the parent as the primary focus. Programme objectives aimed at imparting child rearing skills to parents with little or no direct contact between the child and professionals and paraprofessionals directing the programme (Gordon, Guinagh, and Jester, 1977).

A third characteristic accounting partially for the variation among programmes can be identified as locale of intervention. A number of programmes were centre-based (Hodges et al. 1967; Klaus and Gray, 1968; Gray and Klaus, 1970; Beller, 1972; Biber 1977; Karnes, Reid and Zehrbach, 1977, Nimnicht, Arango and Cheever, 1977) while others were home-based (Levenstein, 1970, 1972; Gordon, Guinagh and Jester, 1977; Karnes and Zehrbach, 1977; Palmer and Siegel,

1977). It is important to note, however, that some of the centre-based programmes had home-visit components.

The effects and outcomes of the various programmes have generally been reported with regard to cognitive gains as reflected by IQ scores (Bronfenbrenner, 1975). Varying degrees of effects have been reported. Klaus and Gray (1968) investigated the possibility of offsetting progressive retardation through a specially designed intervention programme aimed at altering the aptitudes and attitudes of culturally deprived children in the direction of enabling them to perform more adequately in their school and outside life. In their report after the first five years, Klaus and Gray (1968) showed that children receiving intervention tended to be consistently superior to children in a control group on tests of intelligence, language and reading. In fact gains made by children in the experimental group were maintained at a significant level for four years.

In the Milwaukee Project (Garber and Heber, 1977) which enrolled infants born to mentally retarded black inner city mothers, experimental children receiving an intervention programme from early infancy were reported to have shown dramatic IQ gains which were later translated into good academic progress. The report indicated that many of the children were reading before first grade.

In a study that basically involved training parents to teach their own children (Karnes, Teska, Hodgins, and Badger, 1970), children whose mothers received the training

were significantly superior in both Binet IQ and ITPA performances. The two-year training programme resulted in experimental children scoring 16 IQ points above control children. On the ITPA Karnes et al (1970) reported that while the experimental group closely approximated its mean chronological age, the control group was nearly 6 months below its chronological age. In fact in an earlier study spanning a period of only three months, Karnes and her associates had obtained even more spectacular results (Karnes and Zehrbach, 1977). The programme involved 30 children whose mothers participated in a training programme covering 12 weekly sessions of 2 hours duration. The experimental subjects are reported to have evidenced a 6 1/2 month Stanford-Binet MA growth during the three-month treatment period, a gain which is greater than would be expected by increase in chronological age only. The control group, on the other hand, manifested a MA gain of only 3 months. On the Stanford-Binet the experimentals showed a gain of 7.5 points as compared to no-gain by the control group.

The effects of minimal intervention has also been examined by Palmer and Siegel (1977) using two groups of children who entered the intervention programme at ages 2 and 3 respectively. An evaluation of programme effects two years after cessation of the programme showed that children entering intervention at age 2 and those entering at 3 outperformed the control on intellective tasks. The two

experimental groups, however, showed no difference.

Two programmes whose positive effects are remarkable beecause they tended to be more lasting than many others reported deserve special mention. These are the programmes by Levenstein (1970) and Karnes and Badger (1969). Levenstein's Verbal Interaction Programme aimed at fostering stronger mother-child interaction. Five differently treated experimental groups were used and substantial gains were achieved by all five groups. Children entering the programme at age 2 showed gains of about 15 I.Q. points over controls and these gains were maintained 3 to 4 years after programme termination. The programme by Karnes and Badger (1969) engaged mothers of disadvantaged infants in weekly group meetings aimed at helping them to establish a working relationship with their 1 to 2-year old infants and to instruct them in teaching techniques to be used in the home. Results comparable to Levenstein's were obtained. A follow up study after 3 years of programme termination revealed a mean IQ superiority of 16 points by the experimentals over the controls.

While greater success, even if minimal, can be found in the literature, it is important to note the concern that has been expressed over the durability of such intervention effects. In fact an important reaction to the preschool intervention programmes , especially after the Westinghouse evaluation (Cicirelli, 1969) was that these programmes had failed. The studies cited above and a few others had

demonstrated that preschool intervention produces substantial gains in I.Q. The concern then was over the realization that these gains were produced only for as long as the programmes lasted. (Bronfenbrenner, 1975). Follow-up investigations were showing that experimental groups did not continue to make gains when intervention continued beyond one year; moreover the initial gains made tended to "wash out" after termination of the programmes (Bronfenbrenner, 1975). This finding has been confirmed in a comparative study of four such prograames (Miller and Dyer, 1975).

While "fadeout" results from early intervention programmes with disadvantaged children did suggest the possibility that the effects of preschool intervention consisted primarily of temporary acceleration of the normal course of development rather than basic changes in level and style of functioning, there has been a growing and justified reaction to the use of "washout" effects as a basis for concluding that the early intervention efforts of the sixties were a failure. This reaction has been based on the premise that no programme can be expected to function as inoculation for protecting children from deleterious effects of poor environments (Bereiter, 1972; Stem, 1968; Pilling and Pringle, 1978). Thus to some extent the widespread disenchantment which the "fading out" of intervention gains has produced is unreasonable. Pilling and Pringle (1978) equate it to "expecting that a starved child who gains weight when temporarily provided with enriched diet would

not lose weight again when returned to the starvation diet" (p. 26). In fact Campbell and Frey (1970) have argued that a decrement in performance after the cesstion of special programmes is exactly what should be expected on the basis of two assumptions, namely (i) group differences produced by the programmes were totally or partially learned, and (ii) following the compensatory or intervention effort the intellectual quality of the environment falls back to its original level.

The impetus for early intervention with handicapped and at-risk children comes from the enormous evidence emanating from the demonstration and research programmes of the sixties, namely that at least while they last such programmes improve the child's condition in some way. The fadeouts should be seen as arising from a number of factors: (1) specific programming weaknesses which when corrected can lead to more lasting effects; (2) the use of IQ as a measure of intervention efficiency. It is being argued currently that social competence rather than IQ should be the primary measure of the success of intervention efforts (Zigler and Trickett, 1978; Zigler and Seitz, 1980). As Zigler and Seitz argue, the IQ alone is an inadequate indicator of programme outcome. Social competence is a broader measure of intervention outcome since it includes measured intelligence as well measures of physical health and well-being, achievement, and motivational and emotional attributes (Zigler and Seitz, 1980). With regard to the first reason

for the seeming failure of intervention efforts it is important to note that a number of studies that manifested more lasting effects (Levenstein, 1970, 1972; Karnes and Badger, 1969) included certain critical components of early intervention which were lacking in some earlier studies. Bronfenbrenner (1975) after reviewing a number of intervention programmes makes useful suggestions on the critical components of intervention programmes. These components are discussed later in this chapter.

Contemporary intervention programmes with handicapped and at risk infants draw very much on these suggestions (Bricker and Bricker, 1976; Hayden and Haring, 1976; Horton, 1976; Kysela, Daly, Doxsey-Whitfield, Hillyard, McDonald, McDonald, and Taylor, 1979). In addition, measures of social competence and individual progress on criterion measures are increasingly becoming the yardstick for measuring the effectiveness of intervention.

Early intervention with at-risk and handicapped children

The provision of medical, nursing, and social services to at-risk and handicapped infants and their families has increased in many countries in recent years. While such good pediatric and other forms of care are highly desirable these are often not enough to facilitate optimum development with such children. A carefully planned and well executed programme of educational and/or developmental intervention is usually required to promote optimum growth and

development (Kass, Sigman, Bromwich, and Parmelee, 1976). The prevention of mental retardation and other related developmental disabilities as well as the amelioration of the conditions of children for whom prevention is virtually impossible constitute the goals of most early intervention efforts with at-risk and handicapped children (Tjossem, 1976; Kysela, Marfo and Barros, 1980).

Consequently, much attention has been focused on infancy and the first years of life giving rise to the development of intervention strategies for at-risk and handicapped infants and young children. As with the early intervention efforts of the sixties with disadvantaged children, early intervention with at-risk and handicapped children has gained much impetus from our knowledge of the plasticity of the central nervous system during the early years (Lipton, 1976; Barrera et al. 1976) and also from the belief in the ability of rich early experiences to positively influence a whole range of human abilities including cognitive abilities (Gordon, et al 1977; Bloom, 1964).

A distinction may be drawn between at-risk and handicapped children at this stage. 'At-risk' may here be equated to vulnerability. Tjossem (1976) has identified three categories of vulnerable infants and children in need of intervention, namely: 1) infants manifesting early appearing aberrant development related to diagnosed medical disorders with *established risk* for delayed development, (2)

infants at *environmental risk* consequent to depriving life experiences; and (3) infants at *biological risk* as determined by increased probability for delayed or aberrant development consequent to biological insult. Down's Syndrome is a good example of established risk. Environmental risk applies to biologically sound infants who require corrective intervention because of sufficiently limited early experiences including maternal, family and health care. Consequently children at environmental risk were the focus of the intervention programmes sparked off by Headstart. Children at biological risk are those who present a history of prenatal, perinatal, neonatal and events of early development suggestive of biological insult to the developing central nervous system. These three categories define "at-risk" children; however, the review will focus on the first and the third categories. These make up children with risks for developmental disorders of constitutional origin.

The term "handicapped" then may be reserved for children in whom established handicapping conditions have been identified. The distinction between the two categories of children is necessary for one reason: many of the pioneering early intervention studies and programmes with at-risk and handicapped children involved children considered at risk rather than children exhibiting more severe handicapping conditions (Solkoff, Yaffe, Weintraub and Blase 1969; Scarr-Salapatek and Williams, 1972).

If it could be said that the effects of early educational intervention with disadvantaged children have not been spectacular, even much less is known regarding the effects of early educational and/or developmental intervention for at-risk and handicapped children (Tjossem 1976). Generally this is due to the fact that intervention for handicapped and at-risk children is a comparatively recent development in the history of Special Education, In fact as Tjossem (1976) notes:

> major intervention studies following sound principles of research design initiated in infancy and employing adequate samples drawn from a well defined population have only recently been initiated.
>
> p.4.

Nevertheless, a number of positive results have been reported from several intervention studies and demonstration projects involving at risk and handicapped children. With regard to young at-risk infants the effects of intervention have not been studied in relation to academic and cognitive skills only. Solkoff, Yaffe, Weintraub, and Blase (1969) studied the immediate and subsequent effects of handling on the behavioural and physical development of low birth weight infants. Their results with these biologically at-risk infants indicated that experimental infants receiving intervention procedures were not only more active in the short run, but also regained initial birth weights faster than control infants who did not receive extra handling.

In a study involving premature infants of improverished mothers (Scarr-Salapatek and Williams, 1972) experimental infants were given visual stimulation in their isolettes in addition to social stimulation (handling, talking to, and rocking) during eight half hour feeding sessions. During house visits a social worker provided additional stimulation to the infant and advice to the mother concerning care. At the end of one year most of the experimental infants were at normal or near-normal levels of development with only 21 per-cent having IQs below 90. The control group infants, on the other hand, remained one standard deviation below the norm and 67 percent had IQs below 90.

Regarding physical handicaps, a few studies have examined the effect of early intervention on hearing impaired children. Liff (1973) compared the spoken language of six children who had gone through an early intervention programme for hearing impaired children with a group of five hearing-impaired children who had not received any intervention and also with a third group made up of six normal hearing children. All the children in the study were enrolled in the second grade in the same public school. Fifty consecutive utterances produced by the children in each of the 3 groups were analyzed according to Lee's Developmental Sentence Types (Lee, 1966). The results indicated that the language competence of early intervention children was very similar to that of the normal hearing group. The only significant differences found were between

the intervention group and the non-intervention hearing-impaired group, and between the non-intervention hearing-impaired group and the group of normal hearing children.

The effects on later educational achievement of early intervention with hearing impaired children have also been demonstrated through the Bill Wilkerson Hearing and Speech Programme (Horton, 1976). Fifty-three children who had been in an intervention programme were compared, during second grade, with 53 normal second graders on the Metropolitan Achievement Test. Except for the lower performance in Math the hearing-impaired children obtained higher mean percentiles on all the four other subtests. Horton (1976) concludes that projects like the Wilkerson programme clearly demonstrate that early identification and intervention have tremendous pay-offs in habilitation and normalization of hearing impaired children.

The impact of early intervention on the physical and mental development of more severely handicapped infants has been demonstrated in a recent study by Maisto and German (1979). The study demonstrated further that intervention effects were significantly greater when intervention was initiated before eleven months of age than when it was initiated after age eleven months.

Early intervention with Down s syndrome children

Among infants considered to be at risk those with Down's syndrome are one of the easiest to identify because they show specific physical characteristics as early as birth. Consequently Down's syndrome children constitute one group of at-risk children who can be provided with intervention at the earliest possible time.

The principal characteristic of Down's syndrome is subnormality, which is severe in the large majority (Carr, 1975). However, while the genetic base of Down's syndrome has led clinicians to assume too easily that all Down's syndrome persons are similar in intellectual ability as they are physically (Connolly, 1978) the wide range of IQ levels reported suggest far less homogeneity among Down's syndrome children. The literature on levels of IQ of Down's syndrome children portrays more disagreement than consistency among researchers (Hayden and Haring, 1976).For example ,while Doris and Sarason (1969) categorized most Down's syndrome children as moderately retarded to dull normal a study of 13 Down's syndrome children (Carter, 1966) reported IQs of 80 to 120. In fact Carter's (1966) finding agreed with other studies that had reported a number of "higher achieving" Down's syndrome children (Clarke, 1958; Finley, Finley, Rosecrans, and Phillips, 1965; Talkington, 1967; Zellweger, Groves, and Abbo, 1968). On the other hand other sources have associated Down's syndrome with very low level functioning. Heber and Stevens (1965) indicated that Down's

syndrome children would never achieve an IQ beyond 70 while Faber (1968) has stated that these children will not grow mentally beyond the age of 6. In fact in a manual for parents of retarded children French and Scott (1967) advised that Down's syndrome children profit little from instruction and that only a few will pass the second grade level. It has once been suggested (Tizard, 1964) that it is ultimately non-productive to attempt to train Down's syndrome children in school-like situations. In fact until quite recently the tendency had been to recommend institutional care for such children (Hayden and Haring, 1976; Doris and Sarason, 1967).

Perhaps what researchers seem to agree on is the major finding that the measured intelligence of Down's syndrome children declines with increasing age from an average of about 70 at 6 months to about 30-40 at 6 to 9 years (Centerwall and Centerwall, 1960; Share, Webb and Koch, 1961; Shipe and Shotwell, 1965; Dicks-Mireaux, 1966; Cornwell and Birch, 1969; Melyn and White 1973, Carr, 1975; Griffiths, 1976). A more recent study (Hayden and Haring, 1977) involving Down's syndrome children in a Model preschool programme and a contrast group in a public school programme appears to confirm this finding. In that study while programme children demonstrated a positive relationship between age and developmental level, the contrast group appeared to be "following the prediction one might make on the basis of previous studies (Hayden and Haring, 1977; p.134). While the reason for this progressive

decline remains unknown (Carr, 1975) the view has been expressed that the apparent decline in IQs of Down's syndrome children is a statistical artifact brought about by "increased psycholinguistic demands of later tests" (Bilovsky and Share, 1970, p. 79). It is doubtful if this opposing view is valid especially in the light of recent studies (Hayden and Harring, 1977) which appear to confirm the decline using criterion referenced tests.

In the light of the established characteristic of progressive decline in functioning among Down's syndrome children early intervention for this group of children is even more cruicial. The goals of intervention for this group then, have been the improvement in the quality of life (Hayden and Haring, 1976) by arresting the progressive decline in functioning. Specifically the major objective has been to promote the children's development of gross and fine motor skills, social development, communication, cognitive development, and self help skills so that their development more nearly approximates the sequential development of normal children (Hayden and Haring, 1976; Kass et al 1976). Contrary to earlier pessismistic predictions (Tizard 1964; French and Scott, 1967; Faber, 1968) a number of research studies and demonstration programmes have shown that this goal is achievable. Through nursery programmes aimed at promoting the motor skills of young institutionalized Down's syndrome children gains in cognitive skills were reported by Kugel (1970) and Wilson and Parks (1970). Dmitriev, Nail and

Harris (1970) taught skills to a 7 month old Down's syndrome infant who was totally unresponsive to his environment. After an intervention period lasting 5 months during which time the child's mother was also trained to work with him at home the child showed achievement in some skills beyond that predicted for a normal child of his age.

The role of home learning and stimulation as positive factors in improving the quality of life for Down's syndrome children has been illustrated by the work of Brinkworth and Collins (Brinkworth, 1968, 1975; Brinkworth and Collins, 1968). Brinkworth found a mean Developmental Quotient of 71.1 in an experimental group as compared with an IQ of 49.23 in a contrast group who had not been exposed to their developmental training schedules yet. This confirms Conolly's (1978) finding that Down's syndrome persons who are home-reared and well stimulated show the greatest general development.

The generation and maintenance of high rates of developmental progress in Down's syndrome children through a preschool programme for home-reared D.S. children has been reported by Hayden and Haring (1977). Down's syndrome children who had been in the project for up to 5 years were reported as having advanced to a level where they were achieving 95% of the tasks expected of normal children of similar chronological age. A comparison group of children in similar primary grades and matched on age were, on the other hand, found to be levelling off at 61% of normal

development.

Clunies-Ross (1979) reported developmental progress data on 36 Down's syndrome infants and young children aged between 4 months and 2 years. The programme resulted in acceleration of development for all 36 children with achievements at and above normal levels being attained in several cases. A further remarkable finding of this study was that the younger children were particularly advantaged by virtue of entering the project with higher D.Q. scores.

In a recent study done in England, Ludlow and Allen (1979) have confirmed the observation that early intensive pre-school stimulation, coupled with parental counselling and full maternal involvement in the programme of stimulation can reduce the decline in developmental quotients of Down's syndrome children and enable them to more nearly reach their potential. Ludlow and Allen compared three groups of Down's syndrome children: Group A consisted of children whose parents had received counselling and who, following an early assesement, had attended either a developmental clinic, normal playground or nursary school for a minimum period of two years before their fifth birthday; Group B was made up of children living at home whose parents had received no specific counselling, and who lacked the facilities available to Group A; Group C were children who had been placed in residential care before their second birthday. The Group A children who had received stimulation showed superiority over the other groups in

general development as measured by the Griffith Scale, in intelligence as measured by the Stanford Binet test, in personal social development quotients as measured by the Griffiths scale, and in speech development. School placement data showed that the proportion of children who were placed in ordinary and private schools was much higher in Group A than in Group B both at five years and at the end of the survey. The Group C children attended hospital school.

Ludlow and Allen reported also the effects of the stimulation and counselling programme on parental attitude. A change from a feeling of hopelessness and helplessness to an optimistic, positive approach and eager reporting of progress was observed. This finding confirms an earlier finding by Bidder, Bryant and Gray (1975). In a study demonstrating the benefits to Down's syndrome children of training their mothers, Bidder et al (1975) reported that one of the most important effects of training was the change in the mother's pattern of daily care of their children from an earlier non-progressive and non-creative attitude. Also using the Griffith Mental Development Scales, Bidder et al (1975) reported that Down's syndrome infants of mothers receiving training were superior to infants whose mothers had no training in language development. The infants in the treatment group advanced at a mean rate of 6.56 months as against a mean rate of 2.56 months by the control group.

Results similar to those reported by Ludlow and Allen(1979) had been reported by de Coriat, Theslenco and

Wakman (1968) in a study of the effects of psychomotor stimulation on the IQ of young children with Trisomy 21. Two groups of Down's syndrome children were examined and Gesell Scale measures were taken every three to six months. A scheme of stimulation was developed for each child in the treatment group. After two years IQ's of the treatment children were compared to those of the control children. The mean IQ of the stimulated group was 82.7 while the unstimulated group showed a mean IQ of 66.4. At five years the IQ's of the two groups were 65.1 and 49.1 respectively, a trend confirming the characteristic decline in Down's syndrome children's I.Q.

Connolly and Russell (1976) compared forty Down's syndrome children in an ongoing early intervention programme with children not in such a programme. The children in intervention attained gross motor, fine motor, feeding and social skills earlier. Their speech development was faster and showed improved family relationships, a finding confirmed by Ludlow and Allen (1979).

Critical variables in early intervention programming

Following the numerous concerns expressed over the "wash out" of effects of experimental and model early intervention programmes with disadvantaged children the critical variables in intervention programming have been examined (Bronfenbrenner, 1974, 1975). The most crucial components of intervention appear to be: (i) site of

intervention; (ii) age of entry into intervention; and (iii) parental involvement. The following section provides a brief review of the literature on the role of each of the three variable in intervention.

Site of intervention

Two broad categories are identifiable with regard to locale of intervention. Early intervention programmes have usually been either home-based or centre based although a few programmes may show characteristics of both categories. In examining the critical contents of early intervention through a comparative study of seven programmes selected from both categories, Bronfenbrenner (1975) reports that "the experimental groups in most home-based programmes not only made substantial initial gains but these gains increased and continued to hold up rather well three to four years after intervention had been discontinued" p. 458). Today, most early intervention programmes especially those with handicapped and at-risk infants, are home-based to take advantage of naturally occurring teaching situations in the child's home environment. It is becoming evident, also, that the use of the home as a base for intervention provides a solution to the problem of generalization (Stokes and Baer, 1977; Kysela et al, 1980) often faced by such teaching programmes.

Age of entry into intervention

The issue of age of entry as a critical variable in intervention programming is more controversial than the

others. Some studies have indicated that age of entry may not be a critical factor in the success of intervention programmes (Braun and Caldwell, 1973; Palmer and Siegel, 1977). Holding duration of participation constant Braun and Caldwell (1973) reported that children entering intervention programmes before age three did no better than later entrants. Palmer and Siegel (1977) also reported that children entering programmes at ages 2 and 3 respectively did not show any difference in gains although both groups of children were superior to a non-intervention group.

However not only is there more evidence to counter these two findings; there is also the theoretical argument that by ages 2 and 3 it is already too late to initiate intervention and therefore the findings by Braun and Caldwell (1973) and Palmer and Siegel (1977) are not unexpected. In a study of the impact of early intervention on the physical and mental development of more severely handicapped infants Maisto and German (1979) demonstrated that intervention effects were significantly greater when intervention was initiated before 11 months of age than when it was initiated after age 11 months. Reporting developmental data on 36 Down's syndrome infants aged between 4 and 24 months, Clunies-Ross (1979) has shown that younger children in the programme were particularly advantaged by virtue of entering the project with high D.Q. scores. In fact in the presence of the virtual unanimity of researchers over the finding that Down's syndrome children

begin with higher functioning levels and decline with age (Centerwall and Centerwall, 1960; Share, Webb, and Koch, 1961; Shipe and Shotwell, 1965; Dicks-Mireaux, 1966; Cornwell and Birch, 1969, Melyn and White, 1973; Carr, 1975; Griffiths, 1976, Ludlow and Allen, 1979) it is logical to argue that the first few months of the child's life are most cruical for initiation of intervention.

Brinkworth (1975) like Maisto and German, has demonstrated an advantage of stimulation beginning from birth over that beginning only twelve months later. At 1 to 2 years of age the average DQ of the early stimulated children was 66.76 as compared to 56.87 in the later stimulated group. Similar patterns have been reported in the study by Ludow and Allen (1979). Group A children receiving early assessment and stimulation showed an average DQ of 70 while Group B children receiving implemention two years late showed an average DQ of 61. Thus notwithstanding the seeming controversy there is far greater evidence to suggest that age of entry is a critical factor in intervention programming.

Parent involvement

In his extensive review of intervention programmes for disadvantaged children, Bronfenbrenner (1974, 1975) has emphasized parental involvement in intervention as one critical variable accounting for the long term success of some programmes and the lack of success in others. Programmes in which parents were trained to teach their own

infants or interact effectively with them (Levenstein, 1970; Karnes and Badger, 1969) demonstrated more lasting effects than programmes employing visiting tutors on a daily basis (Schaefer and Aaronson 1972). Explaining the failure of programmes that employ visiting tutors, Schaefer and Aaronson (1972) have stressed that maternal interest and direct involvement by parents in the teaching process are a critical component of the intervention process.

The study by Levenstein (1972) has gained the status of an example, par excellence, of a clear demonstration of the crucial role of maternal involvement in intervention. Levenstein's approach was to maximize mother-child interaction around the educational materials provided in her programme. Home visitors referred to as Toy Demonstrators were trained to demonstrate the use of toys to mothers. The Toy Demonstrators were urged to treat the mother as a colleage in a joint endeavour on behalf of the child, bearing in mind that the child's primary and continuing relationship was with his mother. Data reported on the five differentially treated experimental groups suggested that the earlier and more intensely mother or child were stimulated to engage in communication around a common activity, the greater and more enduring the gain in IQ achieved by the child.

Assigning reasons for the success of Levenstein's programme, Brofenbrenner (1975) postulates:

> The resulting reciprocal interaction between mother and child involves both cognitive and emotional components that reinforce each other. When this reciprocal interaction takes place in an interpersonal relationship that endures over time, it leads to the development of a strong emotional attachment that, in turn, increases the motivation of the young child to attend to and learn from the mother.
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> p.460.

Gordon (1972) has suggested a phased sequence of intervention beginning with parent intervention in the first two years of life before any group programmes are initiated. Data supporting this proposal have been reported (Gordon, 1973). Of seven experimental groups receiving intervention at varying levels, the only three that still differed from controls by more than 5 IQ points 2 to 4 years after graduation, were those that had received parent intervention in the first year of life and had continued in the programme for either one or two consecutive years. Groups for whom parent intervention was started later did not do as well.

Radin (1969, 1972) has in two separate studies demonstrated that prior exposure to parent intervention enhances the impact of subsequent group programmes. In one study three groups of children exposed to different intervention strategies were compared when they entered regular kindergarten. While the group of children who had only been tutored directly made no additional IQ gains during their kindergarten year, the two groups of children whose intervention included parent involvement achieved further IQ increases of 10 to 15 points. Commenting on the

relation of parent intervention to future group programmes Radin (1972) has noted that a parent education component is important if the child is to continue to benefit academically from a compensatory preschool programme. Furthermore a parent programme does enhance mothers' perception of themselves as educators of their children and of their children as individuals capable of independent thought. Radin maintains that such new maternal perceptions, behaviours, and attitudes resulting from parent programmes are conducive to intellectual functioning.

There is some evidence to show that the positive effects of parent involvement transcend maintenance of cognitive gains by the child on whom the intervention was ultimately focused. A number of studies have revealed that parent involvement in intervention did not benefit the target child alone but also his younger siblings (Gray and Klaus, 1968; Klaus and Gray, 1976); Gray and Klaus have referred to his spread of intervention effects as vertical diffusion.

In providing intervention for handicapped and at-risk children, parent involvement appears to be even more cruical. Tjossem (1976) stressed that training and support for parents as teachers is the most promising approach to intervention with infants at risk. Similarly, Stone (1975) has proposed that the goal of early intervention should be to assist the mother of a handicapped or at-risk child to develop special parenting skills to facilitate the child's

functioning. In a discussion of early education of the handicapped Karnes and Zehrbach (1977) have identified strong parent involvement as an important variable in any exemplary intervention programme.

Today a number of early intervention programmes for handicapped and at risk infants emphasize parent involvement. Among these are the University of Washington Model Preschool Centre for Handicapped children (Hayden and Dmitriev, 1975), the Marin County Atypical Infant Development (AID) Programme (Nielsen, 1975), the Portage Project (Shearer and Shearer, 1976), the Early Education Project, Edmonton (Kysela, 1978). Shearer and Shearer (1976) have justified the emphasis on home-based programmes and parent involvement with the following reasons:

1. Because learning takes place in the home environment, there is no problem in transferring back to the home what has been learned in a clinic or school.
2. The home programme base provides direct and constant access to behaviour as it occurs naturally. Differences in cultures, lifestyles, and value systems can be incorporated into curriculum planning with relative ease.
3. It is more likely that learned behaviour will generalize and will be maintained, because the behaviour has been learned in the child's "normal" setting and has been reinforced by the natural reinforcing agent, the parent.
4. Teaching in the home provides maximal opportunity for

full family participation in the teaching process.

5. The home setting provides access to a wider range of behaviours than might be observed in a more formal school setting.
6. It is possible that training parents to work with existing behaviours will prepare them to handle new behaviours and new situations as they may occur in future.

Parent involvement may be seen as a desirable model for yet another reason. The emotional problems that arise in a family subsequent to the birth of a handicapped child have been very well documented. Today one of the frequent consumers of counselling services are families with handicapped children. Studies continue to show that one of the by-products of parent involvement in intervention with handicapped children is positive change in parental attitudes towards their handicapped children and their care (Bidder et al., 1975; Ludlow and Allen, 1979). Some intervention studies focusing on disadvantaged children have reported similar findings (Gordon et al., 1970; Gordon, 1973; Karnes et al, 1970; Klaus and Gray 1968). Klaus and Gray reported specifically that intervention programmes succeed in modifying the manner in which the mother and her disadvantaged child relate to each other following initiation of intervention.

The extent to which parent involvement has been regarded as a critical component of early intervention is

perhaps well attested to by Stramiello's (1978) national study of 103 early childhood programmes for handicapped and at-risk children in the United States; the programmes represent about 60 per cent of the total number of early education programmes funded by the Bureau of Education for the Handicapped (B.E.H., Gearheart, 1980). Of the 103 programmes studied by Stramiello (1978), 95% per cent reported that they utilized active parent involvement.

Mother-Child Interaction

For a long time it was conventionally held that the mother's behaviour influenced the infant (Schaffer, 1974; Bromwich, 1976;Clarke-Stewart, 1977; Parke, 1978). Consequently studies on infant development and behaviour tended to focus on maternal variables and behaviours considered crucial to the child's development. The notion that the infant's behaviour can and does affect the mother's was less widely accepted (Bromwich, 1978). In recent years, however, the socialization process has come to be seen as an essentially two-way transactional process(Schaffer, 1974; Clarke- Stewart, 1977; MacLean and Snyder-MacLean, 1978; Thoman, 1980).

Schaffer (1974) notes that there has been a switch from the study of the experience-giving parent to that of the experiencing infant in the light of evidence that the infant is a far more competent organism, psychologically, than we originally gave him credit for. Recent research on the

impact of the infant on the caregiver (Thomas, Chess and Birch, 1963; Brazelton, 1969; Bell, 1971; Harper, 1971) confirms the reciprocal influence of both caregiver and infant on each other.

The crucial role of mother-child interaction in the development of the child has been well documented in the past few years. Its importance is seen, among other things, in the strong relationship between attachment -which is a product of mother-child interaction - and cognitive development (Schaefer 1970; Eveloff, 1971; Mussen, Conger, and Kagan, 1974; Pilling and Pringle, 1978). Pilling and Pringle (1978) observe that the one-to-one relationship and the continuing and reciprocal nature of mother-infant interaction promote maximal learning and progress. Similarly Bromwich (1976) suggests that a mutually satisfying relationship between mother and infant is a prerequisite for the infants optimum development. In line with her suggestion, Bromwich (1976) has developed an early intervention programme whose focus "is not on teaching the mother to teach skills to her infant, but on enhancing the quality of mother-infant interaction" (p 439). In this programme six levels of maternal behaviour progression have been developed the first three of which comprise the affective base of mother-infant interaction favourable to infant development. The last three are more cognitive and include: (1) mother's demonstration of awareness of materials, activities, and experiences suitable for her

infant's current stage of development, (2) mother's initiation of new play activities and experiences based on models provided by the home teacher, and (3) mother's independent generation of a wide range of developmentally appropriate activities and experiences interesting to the infant.

Murphy (1967) has shown the relationship between mother-child interaction and early sensori-motor development, while White (1963) suggests that mother-child interaction, by virtue of the emotional support it generates, fosters the intrinsic motivation that leads to the infant's sense of competence.

Parke (1978) has noted that the assumption underlying the increasing effort devoted to examining the nature of early parent-child interaction in recent-years is that "an understanding of the processes governing the patterns of interaction between infants and parents will yield early clues to the general problem of social and cognitive development" (p 69).

However research focusing on mother-child interaction in families with atypical or at-risk children is very limited (Vietze et al. 1978). Fraiberg (1971) has studied interaction between blind infants and their mothers, while observations of interaction between mothers and their celebral palsied children have been reported in some studies (Shere and Kastenbaum, 1966; Kogan and Tyler, 1973). Also mother-child interactions in families with mentally retarded

children have been reported by Kogan, Wimberger, and Bobbitt (1969) and Marshall, Hegrenes and Goldstein (1973). In general these studies have shown that the patterns of interaction displayed by mothers of atypical children are different from patterns exhibited by mothers of normal infants.

Kogan, Wimberger and Bobbitt (1969) reported that mothers of retarded children showed much lower levels of submissiveness to their children than did comparison mothers. Furthermore, mothers of the retarded children showed less sensitivity or responsiveness to their children. In a similar study Kogan and Tyler (1973) compared retarded, physically handicapped, and normal children interacting with their mothers and found that the mothers of both groups of atypcial children were more overprotective than were the mothers of the non-handicapped children. It has been concluded from these studies that "there is some disturbance in the mother-child interactional system when the child is atypical (Vietze et al., 1978).

Parent child interaction research has important implications for early intervention programming with handicapped and at-risk infants. In a review of studies on the long term impact of various perinatal risk factors on later cognitive and social functioning, Sameroff and Chandler (1975) found little support for a traditional model of development which assumes that the contributions of constitutional and environmental factors are independent of

each other. Emphasizing the role of the environment in development Sameroff and Chandler (1975) noted that the long term prognosis of infants at risk for later cognitive and social interaction could only be understood in the context of an understanding of the environment. They reported evidence that high risk infants raised in stimulating and supportive environments were not different from low risk infants. This finding, coupled with the conclusion that there is some disturbance in the mother-child interactional system when the child is atypical (Vietze et al., 1978) underscores the relevance of mother-child interaction research for intervention programming with atypical and at-risk infants. Such research will be highly instrumental in identifying specific maternal interaction patterns which require the attention of intervention specialists.

Programme evaluation

While the question as to whether early intervention for handicapped infants is a worthwhile enterprise may have been settled as a result of a vast amount of research reporting positive results, concerns are, nevertheless, being expressed about evaluation procedures for assessing intervention efficacy. These concerns are related to a more central issue, namely, accountability. Programme evaluation serves to provide consumers with information concerning a programme's utility for their purposes as well as provide funding agencies, including governments, with the feedback

necessary for making crucial funding decisions (Van Biervliet,1979). The growing need to justify the implementation and/or continued support for social action programmes calls for evaluation procedures that are more sensitive to the methods and goals of intervention.

In the area of early intervention programming the critical issues in evaluation seem to centre on the use of IQ (Hanson and Bellamy,1977; Zigler and Trickett,1978; Williams,1977; Bronfenbrenner,1974,1975; Simeonson and Weigerink,1975) and child progress (Bricker and Casuso, 1979) as the sole measures in assessing the success or failure of intervention programmes. While not holding brief for researchers who have solely used the IQ for measuring programme efficiency Williams(1977) explains why this practice has persisted. He writes:

> because intervention studies are in essence longitudinal and follow-up is important, what is required is a measure which is valid across age and developmental levels. Despite its acknowledged limitations , IQ is used because it comes closest to fulfilling that requirement. It is worth remembering that the reason IQ tests are used to assess programme success in the preschool years is because they do well what they were originally designed to do, namely, predict school success
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> p.20.

The predictive quality of an IQ measure notwithstanding, its use as a sole determiner of programme efficiency has been widely criticized. Especially for atypical populations IQ and normative measures in general have been criticized on the grounds that the standardization procedures used for many of these scales excluded deviant

populations(Simeonson and Weigerink,1975; White,Edgar,and Haring,1978).

Several reviewers of the literature and research on early intervention have pointed out that the "fadeouts" of intervention effects may be inherently related to the use of IQ as a measure of intervention efficiency (Bronfenbrenner,1975; Schweinhart and Weikart,1980). Schweinhart and Weikart(1980) have in a recent report recommended that "the earlier preoccupation with IQ as the sole criterion of early intervention effectiveness must be replaced by a broader long term definition of school success"(p.77). Zigler and Tricket (1978) had earlier noted that social competency rather than IQ should be employed as the major measure of the success of intervention programmes.

The need for broader measures of programme effectiveness has also been recognized by Williams (1977), Hanson and Bellamy(1977), and Bricker and Casuso (1979). Williams (1977) suggests that the failure of an intervention programme to demonstrate success may be due to evaluation in areas other than those in which the programme made its primary impact. That is, while much evaluation has been cognitive in nature, programmes may have made the greatest impact on motivational, socio-emotional, attitudinal, etc. factors. Williams (1977) notes further that lack of demonstrated success may also be explained by the fact that programmes may have failed to alter some more pervasive problems underlying performance differences. Regarding this

explanation it is important to note that Bronfenbrenner (1974,1975) has argued that it is the broader ecological variables such as housing, health, employment patterns, and social services that are critical. In fact the notion of ecological validity for research and programming with atypical children (Brooks and Baumeister,1977) has become an important concern in recent years.

Williams (1977) finally cites specificity of measures used in programme evaluation as another possible explanation for the lack of demonstrated programme success. He notes that the most successful early intervention programmes have been based on very specific curricula while, rather anomalously, most programmes have tended to base their evaluation on global measures, usually IQ scores. Honig and Brill (1970) have demonstrated that when more specific skills are assessed gains can be more easily demonstrated.

The use of criterion referenced assessments in evaluating both cognitive and non-cognitive variables in intervention in recent years (Kysela et. al.1981, Bricker and Dow,1980) is a positive response to the call for broader measures of intervention effectiveness. Bricker and Dow (1980) have used a criterion referenced test - the Uniform Performance Assessment System (UPAS; White,Edgar,and Haring, 1978) - to assess the progress of severely handicapped children during intervention. The study reported significant gains in preacademic, communication, gross motor, and social/self-help skills. Procedures for using criterion

referenced assesssment in the implementation and evaluation of an intervention programme have also been described by Kysela and his associates (Kysela et al.1979;1981).

A second equally important but perhaps less emphasized concern in programme evaluation has to do with the preponderant tendency for researchers to use only child progress as a measure of programme effectiveness. As emphasized by Bricker and Casuso (1979) there are many other equally important criterion variables of programme effectiveness. Bricker and Casuso (1979) point out that effects of a programme should not be examined only in relation to child progress but also to parental and family characteristics as well as subsequent school placement.

It is important to note, however, that intervention researchers have performed better in relation to this last concern than to the first. A number of studies, including some cited earlier in this chapter (Ludlow and Allen,1979; Bidder et al.,1975) have examined the effects of programmes on parental attitudes and patterns of daily care.

Summary

In summary the literature on early intervention for both disadvantaged and handicapped children indicates that early intervention is, generally, a gainful enterprise. The seeming fade-out of intervention effects have been attributed to the parochial nature of most evaluations which have tended to use the IQ as the sole measure of programme

outcome. The literature underscores the need to broaden the base of early intervention evaluation to include the examination of effects of programmes on variables other than child progress.

Also the need to pay attention to the most critical varilables in intervention has been emphasized. Programming intervention for the early years, involving parents, and making the home the main locale of intervention have been shown to be related to programme success.

Consequently, in the study that follows an attempt was made to address the central issues in early intervention programming and evaluation. Chapter Three sets out the rationale and specific research questions of this study with regard to several components of the intervention programme while the methodology adopted to ensure a more broad-based programme evaluation is presented in Chapter Four.

THREE: RATIONALE AND RESEARCH QUESTIONS

As highlighted in the introductory and literature review chapters the parochial perspective of much of early intervention evaluation has aroused concern in recent years. In the present study several components of the intervention programme were examined with the view to assessing the effectiveness of each component. The rationale and specific research questions are presented in relation to each of the components of the programme. While the research questions are stated in relation to expected intervention outcomes it also recognized that no definitive answers can be provided in view of the limitations of the research design.

Mother-child behavioural interaction

The process of providing mothers with direct and incidental teaching skills to teach their own infants as well as their new role as not only mothers but also teachers were expected to potentially effect major changes in the mothers' style of interaction with their infants. These potential changes were considered a major intervention effect worth measuring. Consequently, through the mother-child behavioural observation system, the study sought to examine changes in specific mother behaviours over the intervention period. Since mother and infant behaviours are dependent on each other, the study sought also to

examine changes in specific infant behaviours.

Of crucial interest was the interactive nature of mother and infant behaviours. An examination of changes in concurrent and sequential patterns in mother-infant interaction over the intervention period was expected to provide some index of programme effects.

The specific research questions that the study sought to answer in relation to the behavioural interaction component of the programme were:

1. Would parent intervention result in increased stimulation of play activity?
2. Would parent intervention result in increased display of positive emotion toward infant?
3. What effect would intervention have on mothers' initiation of physical contact with infants?
4. What effect would intervention have on mothers' tendency to restrict infants' activity?
5. Would mothers' physical teaching strategies generalize beyond the parent training situation?
6. Would parent training result in increased verbal stimulation?
7. Would intervention result in increased positive mother-directed behaviours in infants?
8. Would intervention enhance infants' mobility in their home environment?
9. What effect would intervention have on infants' play activity?

10. Would intervention enhance infant vocalization?
11. Would intervention result in a reduction in infant negative behaviours?
12. What effect would intervention have on mothers' responsiveness to infant behaviours?
13. What effect would intervention have on infants' responsiveness to mother behaviours?
14. What effect would intervention have on mothers' own behavioural sequences?

Infant Developmental Progress

While intervention strategies may be designed to utilize family as well as community resources, the central target is often the handicapped child. Consequently, measures of child progress constitute a concomitant component of most early intervention evaluation. In this study the intervention programme was designed to improve the developmental functioning of the infants. Consequently, the study sought to examine programme effects on the infants' mental and motor development.

In relation to this component of the programme the following questions were asked:

1. Would intervention enhance infants' mental development?
2. Would intervention enhance infants' physical development and functioning?

General Intervention Efficiency

Broadly, the rationale of the entire study was to determine the general effectiveness of the kind of early intervention programme adopted. While the results of all the levels of analysis were expected to provide a picture of general programme effectiveness, the study sought to examine intervention effectiveness in relation to the extent to which the programme could enhance the development of severely retarded infants in relation to normal developmental rates. One research question was posed, namely:

1. In relation to the rate of development of normal infants how efficient would the intervention programme be in promoting developmental progress in severely retarded infants?

Home Environment

Since intervention was home-based, the study sought, finally, to examine changes in both quantity and quality of the social, emotional, and cognitive support available to the infants in their home environment. The specific research question asked was:

1. What effect would intervention have on the physical and emotional environment of the home?

Chapter four presents the methodology adopted for this study and describes in detail all the instruments used in collecting data to answer the above research questions. The specific forms and levels of statistical anlysis performed on the data and the results of the analysis are also presented and described in Chapter five.

FOUR: METHODOLOGY

Subjects

The subjects in this study were six families with severely retarded infants (4 males and 2 females) ranging in age at the beginning of the study from 5 months to 15 months (mean=8.5; SD=3.4). Retardation in 5 of the infants was associated with Down's syndrome while the etiology of the remaining infant's condition was unknown. This infant was the oldest (age=15 months). The 5 Down's syndrome infants ranged in age from 5 to 9 months (mean=7.2; SD=1.5). None of the infants was an only child. The number of children in each family ranged from 2 (in three families) to 4(in one family); the two remaining families had 3 children each.

Families requiring intervention services in the City of Edmonton are referred to either the Early Education Programme or a second intervention programme at the Glenrose Hospital. All subjects were located in the City of Edmonton and were, at the beginning of the study, awaiting admission into the Early Education Programme (Kysela et al.,1979).

The Early Education Programme (Kysela et. al. 1979) has two basic components: a home-based and a school based programme for severely handicapped and developmentally delayed infants and preschool children. The services provided by the home-based component of the programme are restricted to developmentally delayed and at-risk infants from birth to 2 1/2 years and their mothers. Parents receive

instruction from the programme's home teachers on how to teach basic self-help, communication, cognitive, social, and motor skills to their infants. The programme aims at preparing parents to be teachers of their own infants. While this was the kind of intervention programme the infants and their mothers were waiting to be enrolled in, none of them had been exposed to any kind of formal intervention programme at the start of this study.

Programme Description

Mothers of all six infants in this study were trained to teach skills in four developmental areas to their infants. These areas were the cognitive, motor, self-help, and language domains. Each parent was trained in her own home by a home teacher. The content of the programme in each domain, differed, of course, from family to family since programmes and their objectives were based on the peculiar needs of each infant.

The parent training procedures used were the same as those used in the Early Education Programme in Edmonton (Kysela et al. 1979). Parents were taught how programmes are set up for specific objectives within each of the four developmental areas and then the teaching procedure used to move through the various steps on the programme was introduced. Parents were trained to use two teaching models, namely the Direct and Incidental teaching models.

The Direct Teaching Model

The Direct Teaching Model is a derivation from a behavioural instructional model developed by Engelmann (Becker, Engelmann and Thomas, 1975) and employed in the Early Education Programme (Kysela et al., 1979). The Direct Teaching model has two hierarchical components: attention and instruction. Parents were trained in the use of attention signals to obtain the infant's looking and/or listening. On getting the attention of the infant teaching was initiated. Parents were also trained in the use of the behavioural techniques of reinforcement, giving precise and prompt feedback, and utilizing correction procedures. A prominent component of the Direct Teaching approach was the use of prompts and physical guidance procedures to assist the child in responding to the learning situation. Teaching was initiated with prompts and guidance which were faded out as the child progressed.

Thus in the direct teaching model, the parent was taught how to plan behavioral objectives for the teaching of a skill, how to systematically structure the learning situation to facilitate the acquisition of the skill by the infant, and, finally, how to fade out prompts and guidance as the infant made progress. Parents were encouraged to use this formal teaching approach for a one 15-minute session each day.

The Incidental Teaching Model

The Incidental Teaching Model is an informal teaching procedure designed to help parents capitalize on naturally occurring teachable situations to transmit information to the child, practice the development or generalization of a skill or concept with the child, or teach new skills and/or concepts. While the same instructions, prompts and guidance used during direct teaching may be employed, the emphasis, here, is on the parent being alert and seizing every single opportunity that the infant's interaction with others and the environment might offer, for teaching.

The training of parents took approximately 5 weeks. While varying periods were spent training different parents, the length of time spent on training was in no way related to the parent's level of ability. The sole factor responsible for the varying lengths of time over which training was done was parents' availability for instruction. As much as possible the training sessions were planned to suit the convenience of individual families.

Research Design

It is becoming increasingly evident that traditional research designs and measurement procedures suitable for laboratory research are very difficult to apply in programme evaluation of social action programmes such as early intervention with handicapped and at-risk infants. Several problems arise in any attmept to use group designs in field

evaluation research (Jones, 1979). First, since social action programmes tend to be directed toward specific populations in need of such programmes, it is not always easy to assign units to groups. Second, it is not always ethically appropriate (Bagnato and Neisworth,1980) to assign subjects to experimental and control groups with control subjects either being deprived of intervention completely or being offered some other programme hypothesized to be less efficient.

The research design employed in this study was dictated by practical issues cited above as well as by specific characteristics of the subjects in the study. Since the research questions were related to effects of an intervention programme on severely retarded infants and their mothers it was required that subjects be families who had never been involved in any formal intervention. The families involved in the study were six out of nine potential and easily accessible subjects, being families with severely retarded infants waiting to be enrolled in the only systematically structured early intervention programme for severely handicapped and developmentally delayed infants in the City of Edmonton.Three of the nine families declined to participate.

Given the small number of subjects a one-group pre-experimental design (Campbell and Stanley, 1963) was adopted. Basepoint measures of parent-child interaction, Bayley Scales of Infant Development (Bayley, 1969) and Home

FIGURE 1

DESIGN: ASSESSMENT AND OBSERVATION TIME LINES

DEPENDENT MEASURES	PRE-TRN	PARENT-TRN	POST-PARENT-TRN			
Infant Developmental Progress(B.S.I.D)	X_1		X_2			X_3
Quality of home Environment (H.O.M.E)	X_1		X_2			X_3
Parent-child Interaction	O_1	O_2	O_3	O_4	O_5	O_6

End of Parent Trn.

Observation for Measurement of the Environment (Caldwell, 1975) were taken on each infant before parent training was commenced. During and after parent training repeated measures of the above dependent variables were taken (Fig.1). In all 3 repeated measures of the Bayley Scales and the HOME inventory were taken at three-month intervals over the 9-month period of the study. An average of 6 parent-child observations were made on each family at intervals of 4 to 6 weeks.

The following section describes, in detail, each of the instruments utilized in the study and the procedures for their administration.

The Parent-child Observation System

Observational research involving human or animal behavior may be seen as a four-component process. Holm (1978) lists these major components as follows: (1) devising a coding system that divides the behaviours to be observed into manageable and meaningful catagories (2) observing and recording the ongoing behaviours, (3) summarizing each observation trial, and (4) analyzing the trial summaries. With regard to the first component, this study used a coding system based on one developed by Clarke-Stewart (1973) in which 26 maternal and 23 infant behaviours were observed. In the present study, though, these behaviours were collapsed to include 9 maternal and 8 infant behaviours (Table 1). A number of important considerations influenced the reduction

TABLE 1

MOTHER-CHILD OBSERVATION SYSTEM:
BEHAVIOUR CATEGORIES

INFANT BEHAVIOURS	SPECIFIC BEHAVIOURS INCLUDED
01 Positive M-directed activities.	holds M, affectionate tactual contact, looks at M, smiles, goes to M, gives to M, calls M, shows M, appropriate response
02 Going:place to place	goes/moves about.
03 Looking/ playing with materials	plays, drops, takes, looks at objects/materials.
04 Negative expression	negative vocalization, cries refuses, hurts.
05 Eating	eats.
06 Interacting	looks at other people
07 Expressive physical	(nonverbal) includes expression of state, positive emotion (e.g. laughing loudly, bouncing excitedly), negative emotion (e.g. banging head, hitting M),or desire (e.g. pointing, reaching out for object).
08 Vocalization	calls, vocalizes, vocal demand, imitates.

Table 1 (cont'd)

MATERNAL BEHAVIOURS	SPECIFIC BEHAVIOURS INCLUDED
11 Attending infant's physical needs	attends needs
12 Restricting infant's activity	puts, restrains, refuses to give takes away, punishes, reprimands
13 Physical contact with infant	holds, physical stimulation, affectionate tactual contact, guidance
14 Stimulating infant with materials	plays, gives object to, shows object to, models
15 Looking at infant	looks
16 Positive emotion toward infant	praises, smiles, appropriate response
17 Verbal stimulation	names, instrumental speech, social speech, imitates, verbal prompting
18 Coming and going	comes to room, comes to infant, leaves room, leaves infant
19 Gesture	gesture

in the number of behaviours to be observed. First it was recognized that fewer categories would ensure ease and accuracy in observation since relatively fewer demands are placed on the observer/coder.Care was taken, however, to ensure that the infant behaviours selected would be ones that are crucial in examining the developmental functioning of retarded infants. Similarly the mother behaviours were selected in such a way as to reflect the initial patterns of behaviour crucial to any examination of behaviour and response patterns characteristic of mothers of young infants from birth to 2 years of age. The second and perhaps more important consideration is related to the purpose of observational research. Distinguishing between two general purposes, Sackett (1978) notes that observational research may be descriptive or oriented toward specific hypotheses. The study by Clarke-Stewart (1973) offers a good example of descriptive observational research. The choice of the 9 maternal and 8 infant behaviour categories in this study was heavily influenced by the specific research questions related to the nature and content of the parent training component of the Early Education Programme.

With regard to the second component, namely, observing and recording the ongoing behaviours, it is important to indicate the conditions under which observations were carried out. Generally observational research may be conducted either under relatively uncontrolled field conditions or in structured laboratory settings (Sackett,

1978). In this study the natural home setting of the mother-child dyad was the field of observation and recording of observations was done live in the subjects' homes.

Data recording

Techniques for recording observational data are many and varied. They include voice recording, the use of event recorders which electrically connect ink or heat stylus pens to buttons on a control board, the use of checklists involving paper and pencil, and the use of digital keyboards of varying types. Electronic data collection devices admittedly have several advantages over checklist techniques, especially with regard to the analysis component of observational research. However a checklist technique utilizing paper and pencil recording was adopted in this study because it was relatively inexpensive. The time sampling procedure adopted involved the choice of 10-second time epochs within a 2-minute trial session. Every 10 seconds the observer recorded the occurence of both mother and infant behaviours on separate columns of a stenographic pad. The trial length of two minutes was arbitrarily selected to enable observers not only rest their hand but also give them time outside coding sessions to turn pages, sharpen pencils, etc..

To help the observer keep track of the 10-second time blocks a cassette tape with beeps at intervals of 10 seconds was made. The tone of the beeps was 410Hz. During the observation session the tape was started and through an ear

phone the observer was prompted at the end of each time block by a beep.

Observations were made under three different situations for all families. The total 30-minute observation per visit was broken down into 10 minutes observation of feeding, changing, and free play situations. As much as possible visits were planned to coincide with the infant's meal time to avoid structuring that situation. With this arrangement very little problem was encountered in obtaining a naturally occuring changing situation to observe since changing usually follows feeding. The free play situation was more structured in the sense that the mother was told to enter into a play activity with her infant for 10 minutes. Mothers were told, however, to approach this activity in much the same way as they would in the absence of the observer. Nevertheless, observer effects were not ruled out.

The parent-child observations were done at an average of 4 to 6 week intervals by 2 graduate students. An average of 6 separate observations were made on each child between October 1979 and June 1980. However one mother-child dyad had only 5 observations while another had 7.

Inter-observer reliability

Reliability data were collected at two different time points.At the beginning of data collection three of the six families were observed by the two coders. Inter-observer agreement, defined as the number of agreements divided by the sum of the number of agreements and disagreements,

ranged from 35% to 100% on mother behaviours. The mean was 68%. On infant behaviours agreement ranged from 39% to 100% with a mean of 64%.

Mid-way between the study inter-observer reliability data were collected again, this time on four of the six families (one family was observed twice, giving a total of five observations). On mother behaviours the range of agreement was 50% to 100% with a mean of 76%. On infant behaviours, the range was 22% to 100% and the mean agreement was 71%. Thus generally observers attained more agreement on mother behaviours than on infant behaviours, possibly suggesting greater difficulty in coding infant behaviours. Appendix G reports the detailed inter-observer agreement figures.

The H.O.M.E. Inventory

The HOME Inventory is the more commonly used name for the Home Observation for Measurement of the Environment (Caldwell, 1975) designed to sample certain aspects of the quantity and quality of social, emotional, and cognitive support available to a young child - birth to 6 years - in his/her home. Two separate inventories exist:(1) infants (0-3), and (2) preschoolers (3-6). Only the infant inventory was used in this study since the age range of the subjects at the start and close of the study was 5 to 15 months and 14 to 24 months respectively.

Until quite recently social class or socio-economic status designations have been employed almost exclusively as an index of the adequacy of a child's environment. The development of the HOME Inventory represents a rejection of the use of the concept of social class to collectively encompass occupational, income, and social status as well as the intangible qualities of person-person and person-object interaction constituting the infant's learning environment. The HOME reflects the need to describe and measure the overall transactions that occur daily between the infant and his environment with the view to determining areas in which intervention is needed. It is the relevance of the HOME inventory to intervention with infants that underlies the use of the instrument in this study. The HOME has been shown to be correlated with a number of socio economic status variables including mother's education, father's education, father's presence, father's occupation, and crowding in the home (Elardo, Bradley and Caldwell, 1975). In a more recent study Hollenbeck (1978) tested the validity of the HOME as a measure of early infant home environment. HOME measures were taken on 70 mother-infant dyads and the results confirmed the earlier findings made by Elardo et al. (1975) with regard to the correlations between HOME subscales and socioeconomic subscale variables. In Hollenbeck's (1978) study, three socioeconomic status indicators - family income, maternal, and paternal education - correlated positively at varying but significant levels with each of

the six subtests of the HOME.

In terms of the relationship between the HOME and mental test scores a validation study (Caldwell, 1975) shows 12-month scores on all the six subtests of the HOME to be significantly correlated to Binet scores taken at 36 months. The correlations ranged from .241 (avoidance of restriction and punishment) to .561 (appropriate play materials) and were all significant at the .05 level. The total HOME score at 12 months was also found to be significantly correlated with 36-month Binet scores (.576; $p<.05$).

Of even greater interest is a study in which Bradley and Caldwell (1977) examined the predictive efficiency of the HOME Inventory in predicting retardation. The results of the study involving 91 6-month-old infants showed that the HOME predicts with reasonable accuracy whether a child would be in the low, low average, or average to superior IQ range at age 3. Using a multiple discriminant function analysis, the study reported an accurate prediction of 71% of all children in the low IQ range (i.e below 70 IQ). This finding underscores, once again, the importance of the HOME Inventory as a process environmental measure in early intervention programming for handicapped and at-risk infants.

Administration of the inventory

The Home Inventory is a combination of observation and interview items and has 6 subscales, namely: responsivity of mother, avoidance of restriction and punishment,

organization of the environment, appropriate play materials, maternal involvement, and variety in daily stimulation. A binary scoring system is employed, ie. items are scored either as a "yes" or a "no". Appendix H shows the HOME inventory with its summary sheet.

Two graduate students with previous interviewing experience were trained to administer the HOME. The two interviewers practised on 5 mother-child dyads, attaining a mean inter-rater reliability coefficient of .91. On the whole reliability coefficients ranged from .81 to .96. A conventional method involving counts of agreements and disagreements between the two raters was used in computing the reliabilities as follows: the sum of agreements divided by the sum of agreements and disagreements.

After advance arrangements for visits had been made, the rater went into the home at a time when the child was awake and could be observed in his or her normal routine for that time of day. Since about a third of the items on the HOME are scored from interaction between the mother and the infant, raters were always asked to postpone interview sessions during which the child had gone to sleep prior to the start or at the initial stages of the interview. The interviewer spent the first few minutes at the beginning of an interview in getting acquainted with the mother and the infant. This was necessary to relax both the mother-infant dyad and the interviewer to ensure that interactions and events transpiring during the session would as much as

possible reflect a normal pattern of mother's interaction with the infant.

The Bayley Scales of Infant Development (BSID)

The BSID (Bayley, 1969) is a standardized normative instrument which enables the evaluation of an infant's developmental status in the first 2 1/2 years of life. Since this is a study of early intervention programme efficiency, the need for an instrument which would provide a basis for establishing a child's current developmental abilities and extent of deviation from normal expectancy was considered crucial. It was hoped that the Bayley Infant Scales, while providing this initial information would also offer a basis for instituting early corrective measures in areas where the assessed infant showed evidence of severe developmental delay. Thus the rationale for using the BSID in the present study was not so much to compare the developmental status of the DS infant with his normal peer as to: (1) identify specific areas where the infants needed help, and (2) examine, through the three measures over time, the effects of the intervention process on these specific need areas.

The BSID has three parts: the Mental Scale, the Motor Scale, and the Infant Behaviour record. In this study only the Mental and Motor Scales were used.

The Mental Scale provides a measure of the infant's sensory-perceptual acuities and discriminations, his early acquisition of object constancy and memory and his learning

and problem-solving ability including early evidence of the ability to form generalizations and classifications. Vocalizations and the beginnings of verbal communication are also assessed by the Mental scale. The Mental Development Index (MDI) is the standard score equivalent of the infant's raw score on the Mental Scale.

The Motor Scale, on the other hand, provides a measure of the degree of control of the body, coordination of the large muscles and finer manipulatory skills of the hands and fingers. The Psychomotor Development Index (PDI) is the standard score equivalent of the infant's performance score on the Motor Scale.

Administration

The BSID was administered by a female graduate student of the Department of Family Studies who has had extensive experience in not only administering various normative tests but also working with both normal and handicapped infants and their families. She was responsible for administering the scales to all the infants in the study on all three occasions which were spaced three months apart. The scales were always administered in the presence of the mother/caregiver who was actively utilized in eliciting required responses from the infant when necessary.

Parent-child interaction : Data reduction

A few peculiar characteristics of the parent-child interaction data called for some form of data reduction to enable a more meaningful analysis. As can be seen from Table 2 four mother-child dyads had 6 observations each while dyads 3 and 5 had 7 and 5 observations respectively. Second, although the average interval between any two observations was 4 to 6 weeks, this interval was not very consistent for all families. Table 2 reports observation dates as well as time lengths (in days) between consecutive observations for all mother-child dyads. The cumulative time length from the first observation to each of the subsequent ones is also reported. Third, and perhaps most important, since intervention started at slightly different time points for different mother-child dyads comparable observation numbers did not necessarily fall at points when all mother-child dyads could be said to have received equal amounts of intervention.

The first level of data reduction involved the selection of some data points and the deletion of others for purposes of analysis. The rationale underlying this level of data reduction was that any attempt to: (a) examine patterns of interaction among these mother-child dyads as a group, or (b) examine behaviour changes in the group, or (c) compare individual family patterns of interaction, can be justified only when data can be demonstrated to have been collected at comparable time points for all families. Being a repeated

TABLE 2

OBSERVATION DATES AND INTERVALS BETWEEN OBSERVATIONS

Obs. #	FAMILY NUMBER 01	02	03	04	05	06
1	11:23:79	11:26:79	11:01:79	10:29:79	10:26:79	10:31:79
2	12:20:79	12:20:79	11:29:79	11:30:79	12:19:79	11:27:79
	27/27	24/24	29/29	32/32	54/54	27/27*
3	01:28:80	01:28:80	01:15:80	01:21:80	01:14:80	01:14:80
	39/66	39/63	47/76	52/84	26/80	48/75*
4	02:22:80	02:29:80	02:22:80	02:29:80	02:18:80	03:24:80
	25/91	32/95	38/114	39/123	35/115	70/145*
5	05:06:80	05:01:80	04:01:80	03:31:80	04:29:80	04:30:80
	74/165	62/157	39/153	31/154	71/186	37/182*
6	06:05:80	06:03:80	05:05:80	05:07:80	NIL	06:02:80
	30/195	33/190	34/187	37/191	NIL	33/215*
7	NIL	NIL	06:04:80	NIL	NIL	NIL
	NIL	NIL	30/217	NIL	NIL	NIL *

*Numbers left of the slash represent the length of time (in days) between one observation and the observation immediately preceding it.
The number right of the slash is the cumulative length of time (in days) from the first observation.

All dates are reported in the order: month, day, and year.

measures design it was necessary to ensure a relative degree of equidistance between comparable time points for all dyads in the sample.

Consequently the first observation for all dyads was selected as a pre-intervention measure since for all families it was done just prior to or at the start of parent training. The second observation made 4 weeks later was also selected not only because this time point satisfied the relative equidistance condition, but also because it occurred at the end of parent training for all families. This end-of-training measure makes it possible to examine the concurrent effects of on-going training on the various dependent measures relative to its after-effects.

The remaining observation points were inspected for points at which all families could be said to have received a comparable amount of intervention in relation to the individual starting points. This inspection yielded two additional points coinciding with approximately 3 months and 6 months into intervention respectively. The third point (3 months into intervention) fell at observation number 4 for families 1 and 2 and number 3 for families 3, 4, 5 and 6. The mean cumulative length of time from the first observations to the selected third point was 84 days (SD=7). The final data point selected was an average of 186 (SD=4) days from the first observations. For families 1, 2, 3, and 4 this point fell at observation number 6 (original). For families 5 and 6 it fell at observation number 5 (original).

The period of intervention is defined as beginning from the start and not the end of parent training (i.e. roughly from observation 1) because concurrent effects of parent training on the dependent variables cannot be ruled out.

The second level of data reduction involved the application of the modified frequency (MF) procedure (Hansen,1966) to facilitate data analysis. The modified frequency (MF) approach to observational data collection involves dividing the sampling period into time blocks and classifying the behaviours of interest into a convenient number of categories depending on the research question. A prominent feature of this recording technique is that a given behaviour is entered only once per time block. In the present study, although the sampling interval (epoch) of 10 seconds was considered sufficiently small to allow not more than one behaviour to occur in most intervals, the coders were not instructed to record any given behaviour only once in an epoch. Consequently, a few epochs had more than one of the same behaviours.

Since this situation poses a difficult problem with regard to the determination of possible total fequency (which is very necessary in the absence of consistency in observation time for all observations) the MF technique was adopted on a post hoc basis. Each behaviour was counted only once in every epoch during frequency computations; excess behaviours of the same kind were discarded. This way, the possible total frequency for every behaviour during each

observation was equal to the number of epochs that elapsed during observation.

The third level of data reduction involved the derivation of proportions of possible total frequency for purposes of analysis. The potential duration for every observation was 30 minutes, yielding a possible total MF of 180 for each behaviour. Since the total number of 10-second epochs for each observation was never exactly equivalent to the 180 that made up a 30-minute period, absolute frequencies were not appropriate for analysis purposes. Instead, the total number of occurrences of a behaviour was expressed as a proportion of the total number of epochs in the observation. These proportions served as the units of analysis of the parent-child interaction data.

FIVE: RESULTS

The results of the study are presented in the order of the research questions posed under each of the four components of the intervention programme described in Chapter Three.

Mother-child behavioural interaction

Changes in specific individual mother and infant behaviours as well as in concurrent and sequential patterns of interaction between mothers and their infants are considered across four time points representing pre-training, end of training, 3 months into intervention, and 6 months into intervention respectively. To examine changes in individual mother and infant behaviours over time, a repeated measures analysis of variance (ANOVA) was performed on the proportions of possible total frequency of each behaviour. Table 3 reports the results of the ANOVA on mother behaviours while Figure 2 graphically displays changes in all mother behaviours over time.

In relation to the results displayed in Table 3 and Figure 2, six specific research questions were asked. Each of these questions is examined below.

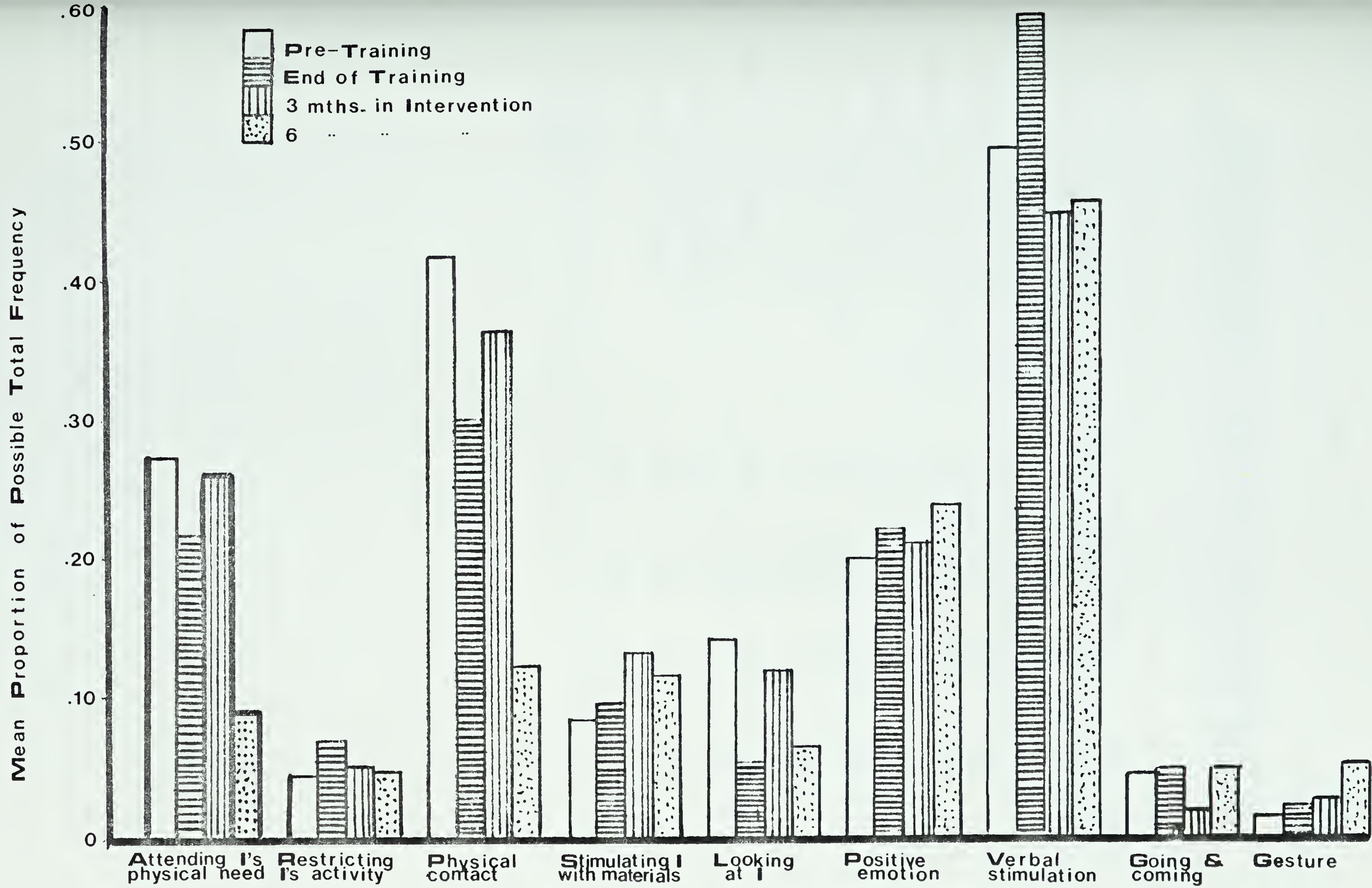

FIGURE 2: CHANGE IN MOTHER BEHAVIOURS

T A B L E 3

MEAN PROPORTIONS OF POSSIBLE TOTAL FREQUENCIES OF MOTHER BEHAVIOURS BY LENGTH OF TIME INTO INTERVENTION

Mother Behaviour	Pre-Trn.	End of Trn.	3 mths	6 mths	F(3,15)
Attendin I's phys. need	.273	.218	.260	.090	3.66*
Restricting I's activity	.045	.070	.052	.049	0.59
Physical contact	.418	.300	.364	.125	6.84**
Stim. with materials	.086	.099	.134	.119	0.55
Looking at infant	.145	.057	.121	.068	1.12
Positive emotion	.201	.222	.212	.240	0.22
Verbal stimulation	.492	.589	.445	.453	1.60
Coming and going	.049	.050	.021	.052	1.08
Gesture	.019	.025	.030	.057	3.00

* p<.05
** p<.01

Would parent intervention result in increased stimulation of infant play activity?

There was a very consistent, though mild increase in mothers' stimulation (with materials) of infants' play activity over time. While the increase did not reach a statistically significant level the upward pattern of increase is worth noting. Although there was a slight drop in the frequency of this behaviour by 6 months into intervention (Figure 3A) the level did not fall below the pre-training level of occurrence. Generally mothers' stimulation of infant play activity was low (8.6% to 13.4%); however by 6 months into intervention this behaviour had risen from the sixth to the fourth most frequently occurring mother behaviour.

Would parent intervention result in increased display of positive emotion toward infant?

From Table 3 positive emotion toward infant had a fairly high frequency of occurrence. Before intervention it was the fourth most frequently occurring mother behaviour (20.1%). By 6 months into intervention it was the second most frequently occurring mother behaviour (24%). However, although the increase was consistent (see Figure 3B) no significant change was found between any two time points.

What effect would intervention have on mothers' initiation of physical contact with infant?

The repeated measures analysis of variance showed a significant decrease in mothers' initiation of physical contact with infants ove time ($F=6.84$; $p<.01$). Figure 3C illustrates the very irregular pattern of change in this mother behaviour. Although the figure shows a drop from pre-training to end of training and an increase from end of training to 3 months in intervention, none of these changes was statistically significant. The post hoc comparison of means showed that the significant decrease in physical contact occurred after three months in intervention; however, the drop was so drastic that differences between each of the first three means and the mean at 6 months in intervention were significant. Despite the significant drop in the occurrence of this behaviour it continued to be one of the most frequently occurring mother behaviours throughout intervention. In fact by 6 months in intervention it had only dropped from the second to the third most frequently occurring behaviour.

This significant drop in mothers' physical contact with infants is not unexpected. By six months in intervention the average age of the infants was 14.5 months. Thus infants were already walking or at least crawling and therefore more independent of their mothers. The increase in infants' mobility (going from place to place) although not significant ($F=2.13$; $p=.14$; see Table 4 and Figure 6 B) supports this interpretation of the significant drop in mothers' physical contact as an important positive finding.

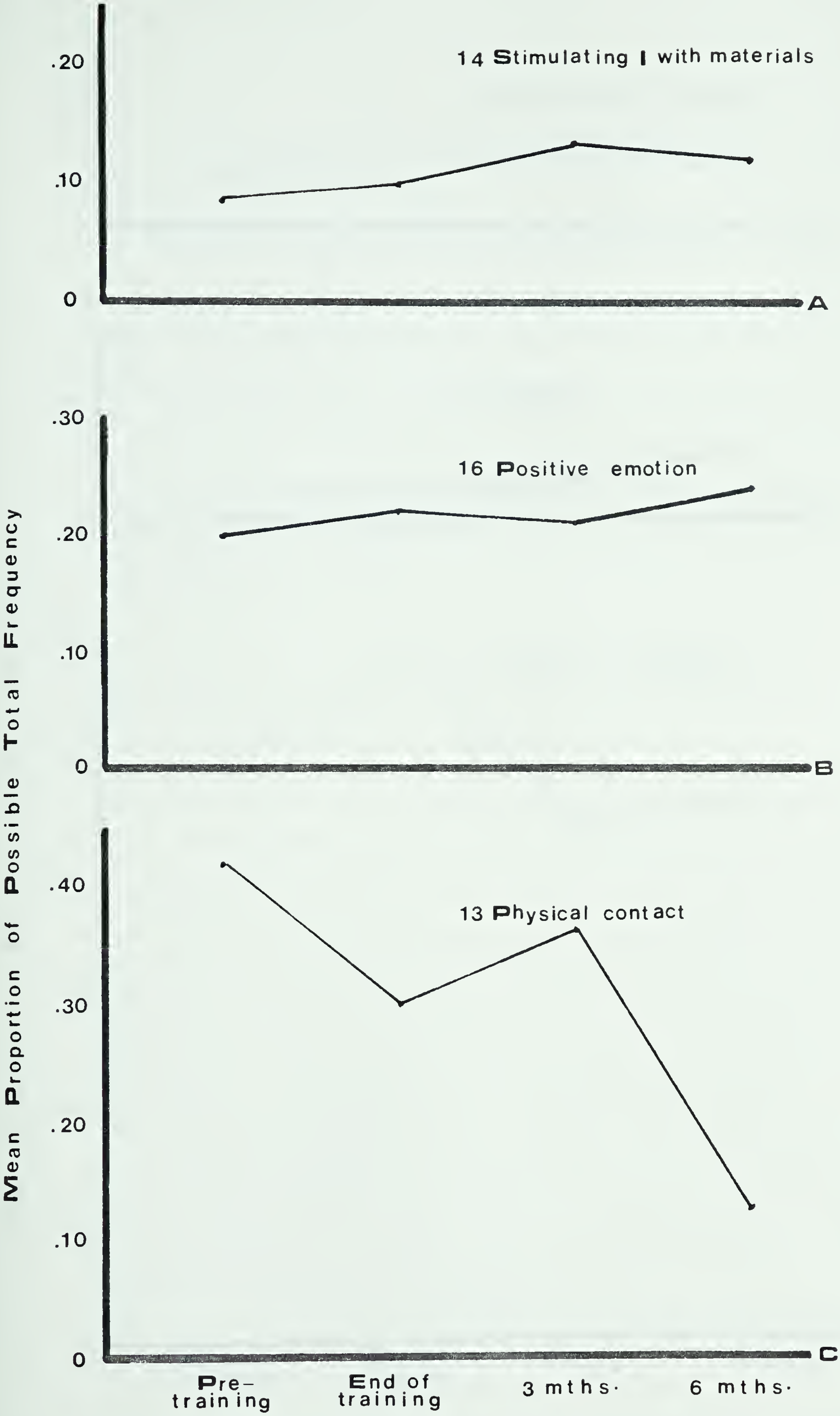

FIGURE 3: CHANGE IN MOTHER BEHAVIOURS 14, 16, & 13

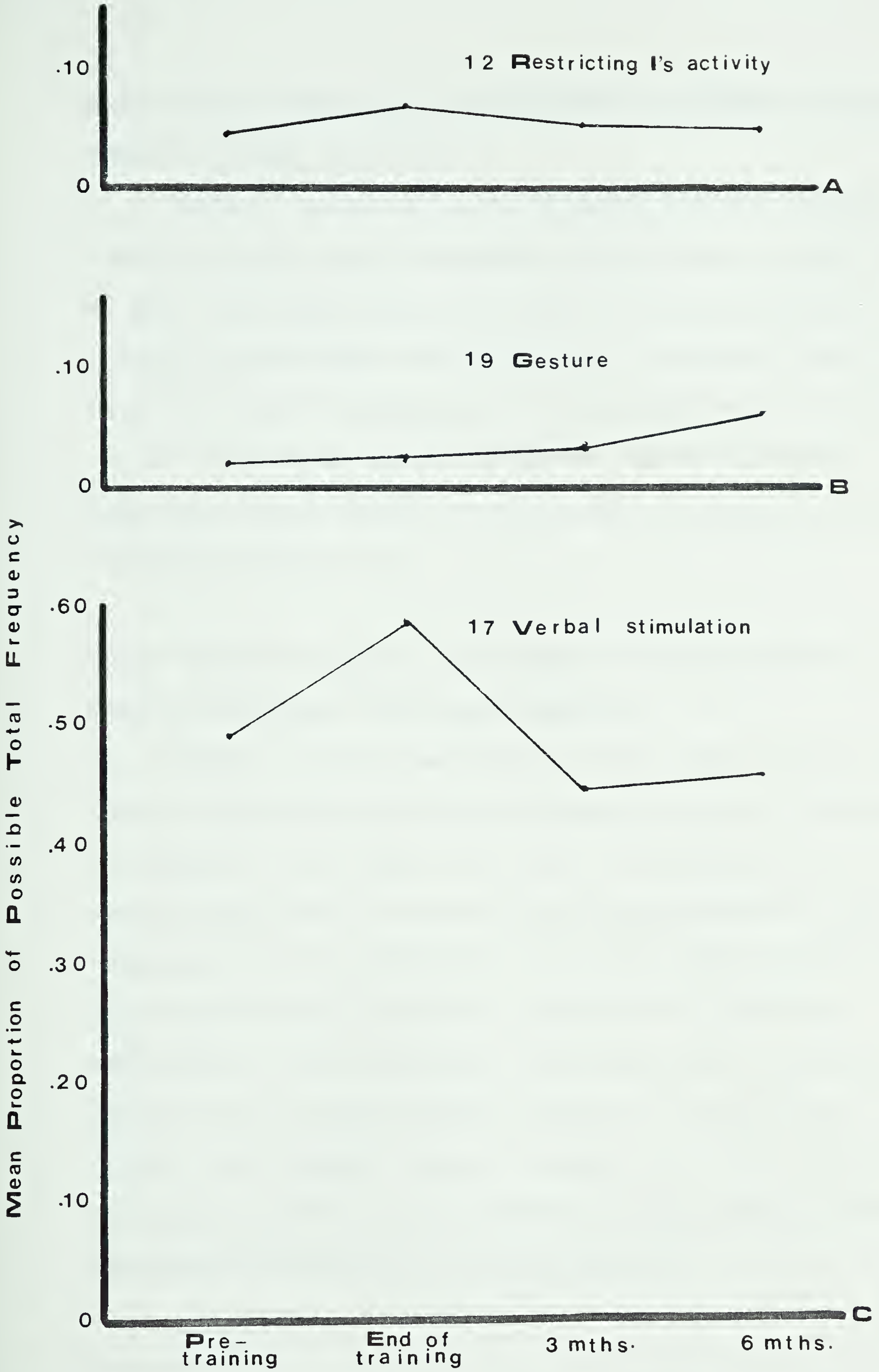

FIGURE 4: CHANGE IN MOTHER BEHAVIOURS
12, 19, & 17

What effect would intervention have on mothers' tendency to restrict infant activity?

Mothers' restriction of infants' activity stayed relatively the same throughout intervention, except for a slight, non-significant increase from pre-training to end of training after which time there was a gradual drop to almost baseline level (Figure 4A). At the beginning of intervention it was the second least frequently occurring mother behaviour; by 6 months in intervention it was the least frequently occurring.

Would mothers' physical teaching strategies generalize beyond the parent training situation?

Mothers' use of gestures in their interaction with their infants was used as an index of physical teaching strategies. Starting as the least frequently occurring mother behaviour during pre-training observation, the frequency of this behaviour rose from 1.9% to 5.7% to become the seventh most frequently occurring of 9 mother behaviours. This consistent and directional increase (see Figure 4B) attained a modest degree of significance ($F=3.00$; $p=.06$). The biggest increase between any two time points occurred between 3 and 6 months in intervention, indicating maintenance beyond the training period.

Would parent training result in increased verbal stimulation?

Mothers' verbal stimulation showed some increase at the end of parent-training but dropped to the pre-training level by 6 months in intervention (Figure 4C). None of these changes was statistically significant, however. Thus no significant change occurred in the frequency of mothers' verbal stimulation of their infants over the study period. However throughout intervention verbal stimulation was the most frequently occurring mother behaviour. Mothers of these severely retarded infants spent almost half of their interactive time providing verbal stimulation.

One other mother behaviour showing statistically significant decline was attending to infants' physical needs. This category of mother behaviour included diapering, dressing, bathing, and wiping of infant's nose. As Table 3 and Figure 2 show, this mother behaviour remained, relatively, at the same level of occurrence in the first 3 months of intervention. However, by 6 months into intervention there had been a significant drop from over 20% occurrence rate to a mere 9% ($F=3.66$; $p<.05$)

To sum up this section, three mother behaviours underwent significant changes during intervention. There were significant declines in attention to infants' physical needs ($p<.05$) and physical contact with infant ($p<.01$). However, the use of gestures increased dramatically,

achieving a marginal level of significance ($p=.06$).

Would intervention result in increased positive mother-directed behaviour in infants?

Table 4 displays the results of a repeated measures analysis of variance performed on infant behaviours. The group means are also plotted in Figure 5. Infants' positive mother-directed behaviour showed a very irregular pattern of change over time (Figure 6A).By the end of parent-training the mean frequency of occurrence had increased from 23% to 31%. This increase was, however, not statistically significant. Between end of training and 3 months into intervention, however, there was a significant decrease in the mean frequency of occurrence from 31% to 18% ($F=4.15$; $p<.05$). By 6 months into intervention there had been an increase to the pre-training level of frequency.

Would intervention enhance infants' mobility in their home environment?

There was a steady, though non-significant increase in infants' mobility (going from place to place) throughout intervention. From a very low mean frequency level of 0.6% mobility had risen to 4.1% by 6 months in intervention (Figure 6B).

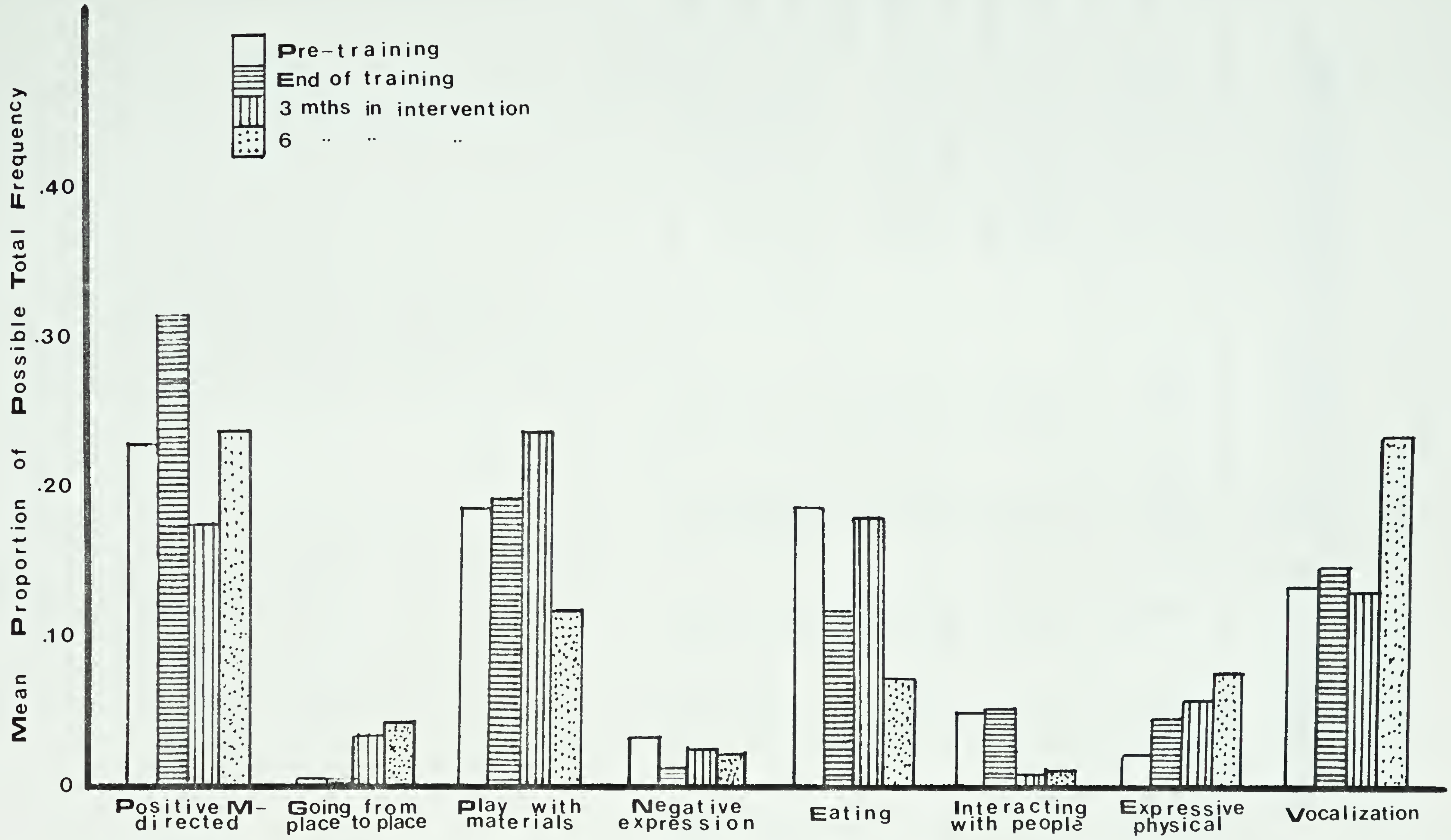

FIGURE 5: CHANGE IN INFANT BEHAVIOURS

TABLE 4

MEAN PROPORTIONS OF POSSIBLE TOTAL FREQUENCIES OF INFANT BEHAVIOURS BY LENGTH OF TIME INTO INTERVENTION

Infant Behaviour	Pre-Trn.	End of Trn.	3 mths	6 mths	F(3,15)
Positive M-directed	.229	.313	.176	.238	4.15*
Going:place to place	.006	.006	.034	.041	2.13
Play with materials	.187	.191	.238	.119	1.56
Negative Expression	.034	.014	.026	.023	0.18
Eating	.188	.119	.180	.074	2.60
Interacting with people	.050	.052	.009	.010	1.56
Expressive physical	.021	.046	.057	.075	2.71
Vocalization	.132	.146	.129	.232	5.95**

* $p<.05$
** $p<.01$

What effect would intervention have on infants' play activity?

Infants' play activity with materials showed a gradual increase between pre-training and 3 months in intervention (19.7% to 24%) but declined sharply to 12% (Figure 6C) by 6 months in intervention. However, neither the increase from pre-training to 3 months in intervention nor the decrease from 3 months to 6 months in intervention was significant.

Would intervention enhace infant vocalization?

Infant vocalization showed no change between pre-training and 3 months in intervention. However, between 3 months and 6 months in intervention the mean frequency of occurrence increased significantly ($F=5.95$; $p<.05$) from 12% to 23%.As compared to other infant behaviours vocalization showed a very high level of occurrence by 6 months into intervention. It rose form the fourth most frequently occurring behaviour during pre-training observation to become the second most frequently occurring behaviour by 6 months into intervention.

Would intervention result in a reduction in infant negative behaviours?

Over the intervention period infant negative expressive behaviours showed a gradual decline (Figure 7A). The biggest drop (3.4% to 1.4%) occurred between pre-training and end of

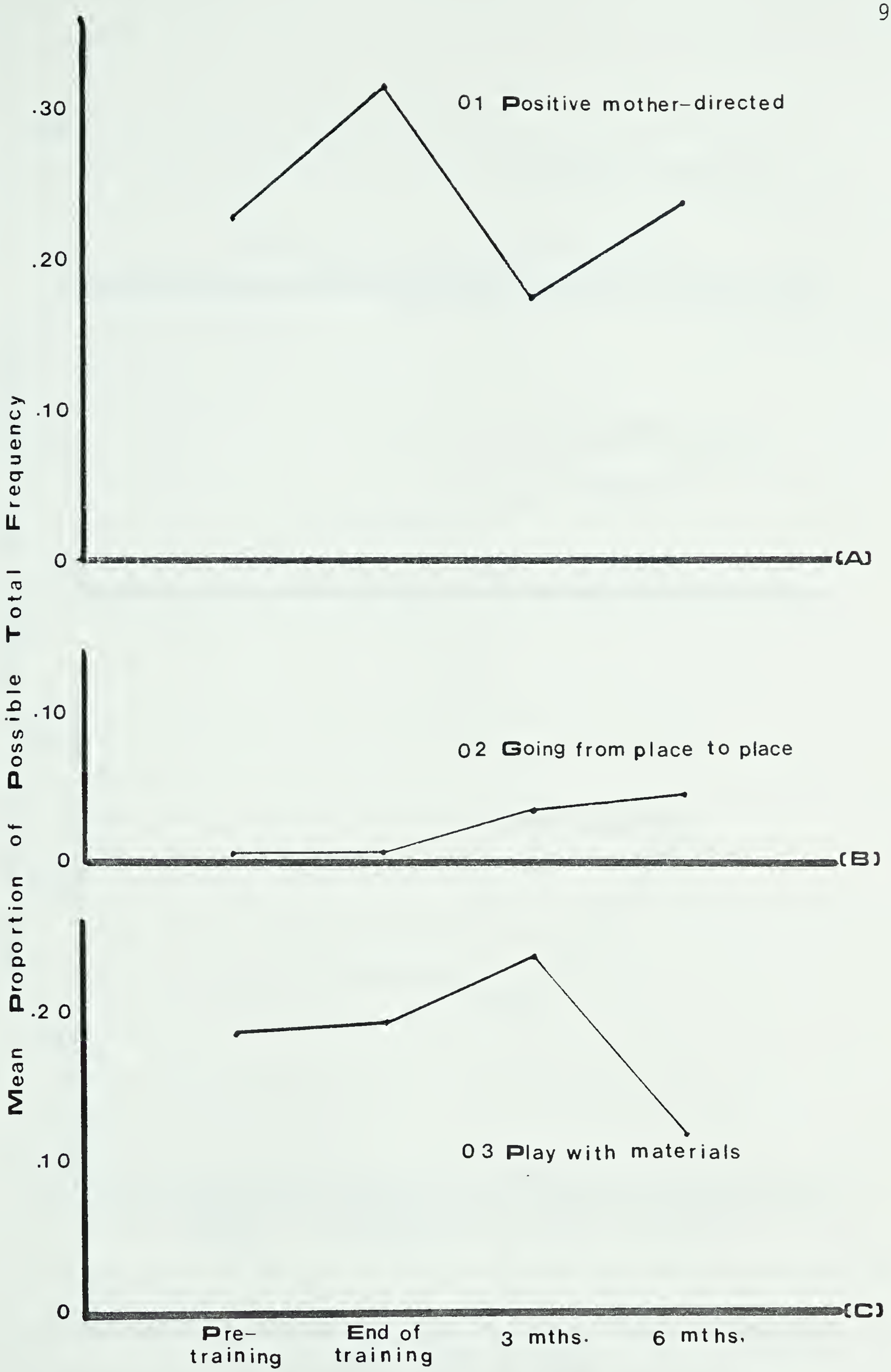

FIGURE 6: CHANGE IN INFANT BEHAVIOURS 01, 02, & 03

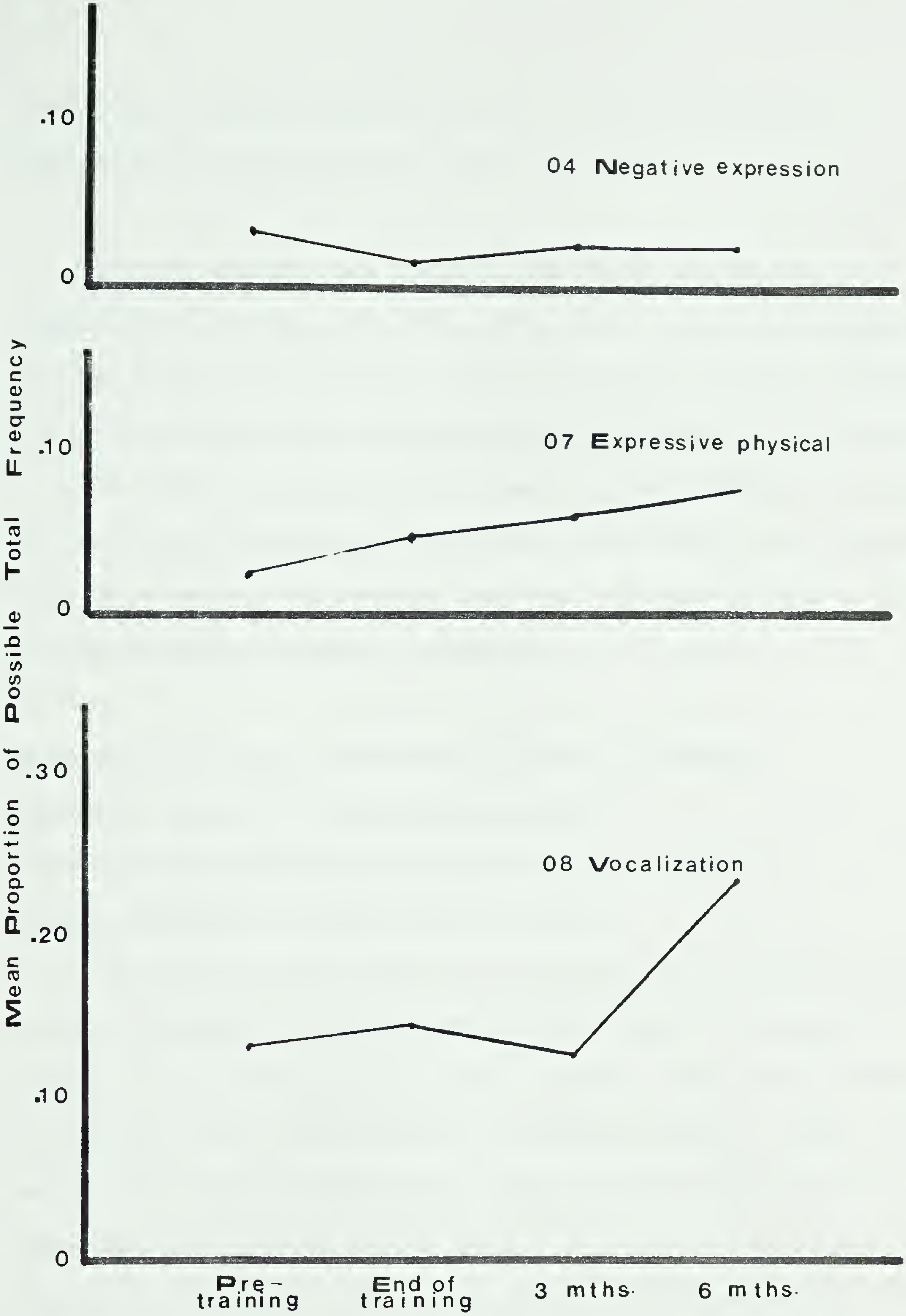

FIGURE 7: CHANGE IN INFANT BEHAVIOURS 04, 07, & 08

training. The declines did not at any time reach a statistically significant level, however.

On the whole, two infant behaviours showed a significant change while two other key behaviours came close to achieving a statistical level of significance. Infants' positive mother-directed behaviours declined significantly ($p<.05$) while vocalization showed a significant increase ($p<.01$). Both expressive physical behaviours and infants' mobility (going from place to place) showed substantial, though non-significant increases.

What effect would intervention have on mothers' responsiveness to infant behaviours?

What effect would intervention have on infants' responsiveness to mother behaviours?

To answer these questions two levels of analysis beyond merely looking at single behaviours were performed on the parent-infant interaction data. First, concurrent patterns of interaction were examined. Co-occurrences of specific mother and infant behaviours were counted and referred to as observed joint frequencies (Obs.J.F). The next step involved the prediction of joint-frequencies from knowledge of the unconditional probabilities of occurrence of the behaviours under consideration. For example, given that infant behaviour 'A' occurred 30 times in a 90-epoch observation, the unconditional probability of occurrence of behaviour 'A'

is 30/90 (.333). Similarly, given that mother behaviour 'B' occurred 50 times during the same observation, the unconditional probability of occurrence of mother behaviour 'B' is 50/90 (.556). On the basis of these two set of frequencies and unconditional probabilities, it could be predicted on the hypothesis of independence that given infant behaviour 'A', mother behaviour 'B' will occur with it .556 x 30 (16.68) times. Assuming that infant behaviour 'A' and mother behaviour 'B' occurred together in 20 epochs, the observed joint frequency of the two behaviours is 20. Bakeman (1978) provides a procedure for assessing the strength of co-occurrences utilizing the observed joint-frequencies (Obs. J.F), the predicted joint-frequencies(Pred. J.F), and a variance component defined as the square root of the predicted joint-frequency times the difference between 1 and the unconditional probability of the criterion behaviour.The difference between 1 and the unconditional probability of the criterion behaviour is represented by the letter 'q'. The resulting statistic is the binomial 'z' defined as:

$$\frac{\text{Obs. J. F.} - \text{Pred. J. F.}}{\sqrt{\text{Pred. J. F.} \times q}}$$

where q=1 minus the unconditional
probability of the criterion behaviour

If z equals or exceeds 1.96 the probability that the pattern of joint frequency occurred by chance is less than 5% and

the two behaviours are said to coincide more frequently than their simple probabilities would predict. In the example given above the Z-value for the strength of co-occurrence will be:

$$\frac{20 - 16.68}{\sqrt{16.68 \times .444}} = 1.22$$

In this study co-occurrence was defined as the occurrence of any two behaviours in the same 10-second epoch. Usually if two behaviours are said to occur together none of them may be considered the criterion behaviour. However, in the analysis presented in this section sight has not been lost of the fact that within each epoch behaviours were recorded sequentially since there were no unique codes for joint occurrences. Thus the definition of co-occurrence adopted in the analysis does not necessarily ignore intra-epoch sequences. Consequently there are two sides to the issue of co-occurrences. The rate at which a mother behaviour will occur with an infant behaviour given that the infant behaviour occurs first can be considered, and so can its converse. Thus in considering the co-occurrence of a mother behaviour with an infant behaviour either of the two behaviours may be seen as the criterion behaviour. This essentially reduces the concurrent analysis to a special form of lag sequential analysis of behaviours occurring within a 10-second epoch.

This approach to the examination of concurrent patterns in mother-infant interaction was necessary for two reasons.

First, since there were no unique codes for joint occurrences of mother and infant behaviours in the coding system (the definition of co-occurrence as behaviours occurring within the same epoch did not change the sequential recording of behaviours), it was important that the form of analysis adopted reflect this feature of the coding system. Second, the lag sequential approach to the examination of concurrent patterns enables an easy comparison of patterns of co-occurrences and lagged sequential dependencies.

The means of the observed and predicted joint frequencies were used in arriving at group Z-values. Changes in concurrent patterns between two time points, pre-training and 6 months into intervention are examined. Table 5A displays the Z-values for co-occurrences for sets of infant and mother behaviours with infant behaviours as the criterion. In Table 5B mother behaviour is the criterion.

To present a clearer picture of pattern changes over time, the z-values are graphed in Figures 8, 9, and 10. The dashed horizontal line below the z-value of 2.0 is a rough approximation of the .05 significance level. Z-values reaching this line or extending beyond it indicate behaviours that co-occur more frequently than their simple probabilities predict. However, as Sackett (1980) points out, although Bakeman (1978) uses Z-scores computed from the above procedures as relative indices of sequential and concurrent relationships "he does not...seriously consider

the Z probabilities in their usual hypothesis testing sense"(p. 313). Disregarding the z=1.96 line, the pre-training and 6 months into intervention bars in the graphs provide a picture of changes in strength of co-occurrence over time.

The pair of infant and mother behaviours that came closest to reaching the .05 significance level by 6 months into intervention (z=1.92 each, given either infant or mother behaviour) were infants' activity with materials and mothers' stimulation of infant play activity (Figure 8A). This pair was followed by infants' positive mother-directed behaviour and mothers' positive emotion (z=1.81 given either behaviour; Figure 9B), and then by infants' play with materials and mothers' verbal stimulation (z=1.36 given infant behaviour, and z=1.56 given mother behaviour; Figure 8C).

In all three sets there was a dramatic increase in the level of co-occurrence over the intervention period. The co-occurrence of infants' play activity and mothers' stimulation with materials rose from z=1.20 to z=1.92. Infants' positive mother-directed behaviour and mothers' positive emotion rose from z=0.84 to z=1.81. The largest increase occurred in infants' play activity and mothers' verbal stimulation. Before intervention the presence of any one of these two behaviours seemed to be inhibiting the other's occurrence with it (z=-.12; see Figure 8C). By 6

T A B L E 5A

CO-OCCURRENCE OF INFANT AND MOTHER BEHAVIOURS: CRITERION=INFANT BEHAVIOURS

Infant Behaviour	Mother Behaviour	z(pre-)	z(6mth)
Activity with materials	Stim. with materials	1.12	1.92
"	Positive emotion	0.74	0.25
"	Verbal stimulation	-0.09	1.36
Positive M-directed	Physical contact	0.84	0.32
"	Positive emotion	0.84	1.81
"	Verbal stimulation	0.74	0.86
"	Gesture	-0.17	1.02
Vocalization	Physical contact	-0.86	0.14
"	Stim.with materials	-0.13	-0.20
"	Positive emotion	-0.05	0.29
"	Verbal stimulation	0.28	0.40
"	Gesture	0.32	0.40

TABLE 5B

CO-OCCURRENCE OF MOTHER AND INFANT BEHAVIOURS: CRITERION=MOTHER BEHAVIOURS

Mother Behaviour	Infant Behaviour	z(pre-)	z(6mth)
Stim. with materials	Act.with materials	1.05	1.92
Positive emotion	"	0.75	0.24
Verbal stimulation	"	-0.12	1.56
Physical contact	Positive M-directed	0.97	0.29
Positive emotion	"	0.83	1.81
Verbal stimulation	"	0.92	1.00
Gesture	"	-0.23	0.92
Physical contact	Vocalization	-1.04	0.09
Stim. with materials	"	-0.13	-0.20
Positive emotion	"	-0.04	0.29
Verbal stimulation	"	0.50	0.44
Gesture	"	0.43	0.35

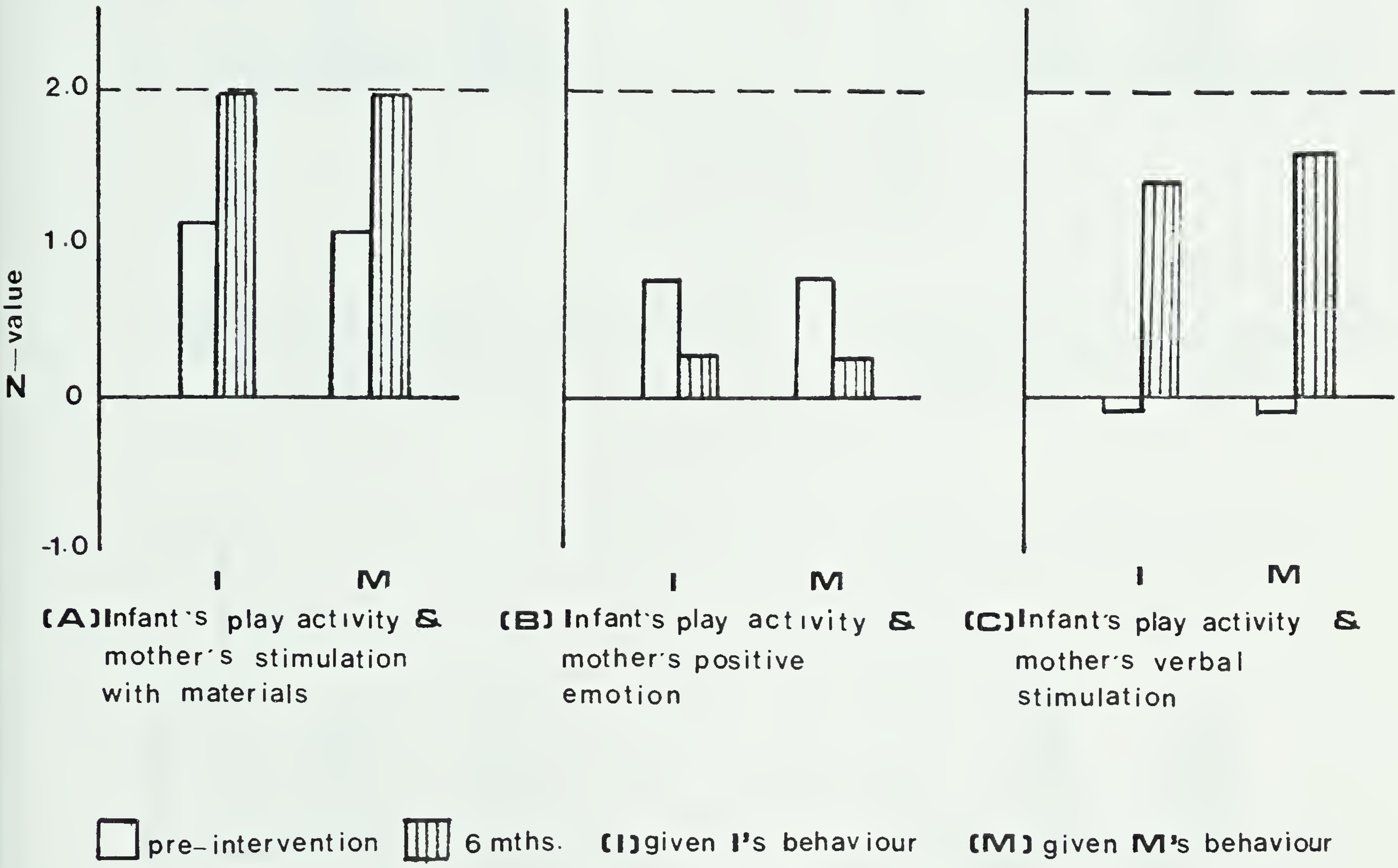

FIGURE 8: CO-OCCURRENCE OF INFANT'S PLAY ACTIVITY WITH THREE MOTHER BEHAVIOURS

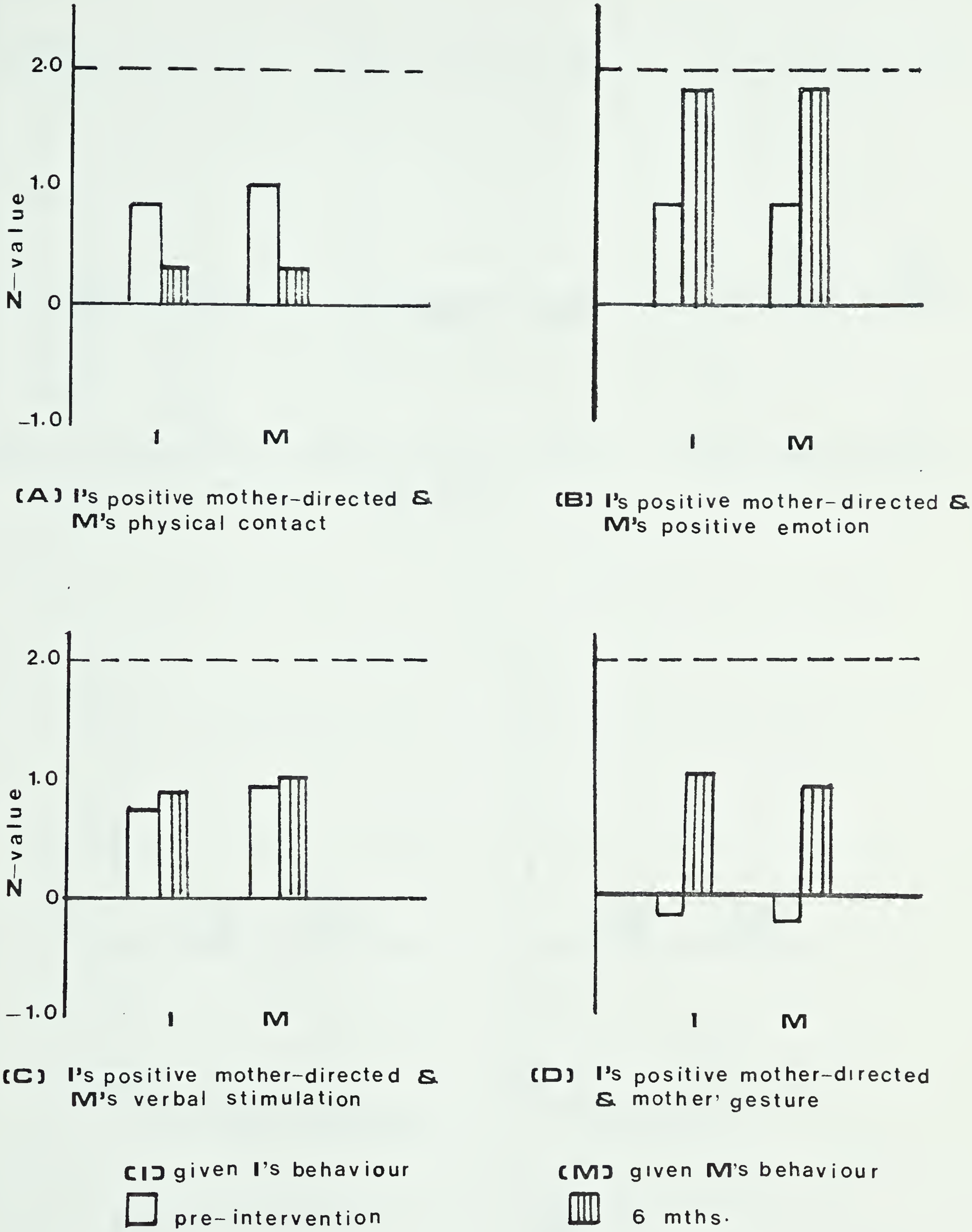

FIGURE 9: CO-OCCURRENCE OF INFANT'S POSITIVE MOTHER-DIRECTED BEHAVIOUR WITH 4 MOTHER BEHAVIOURS

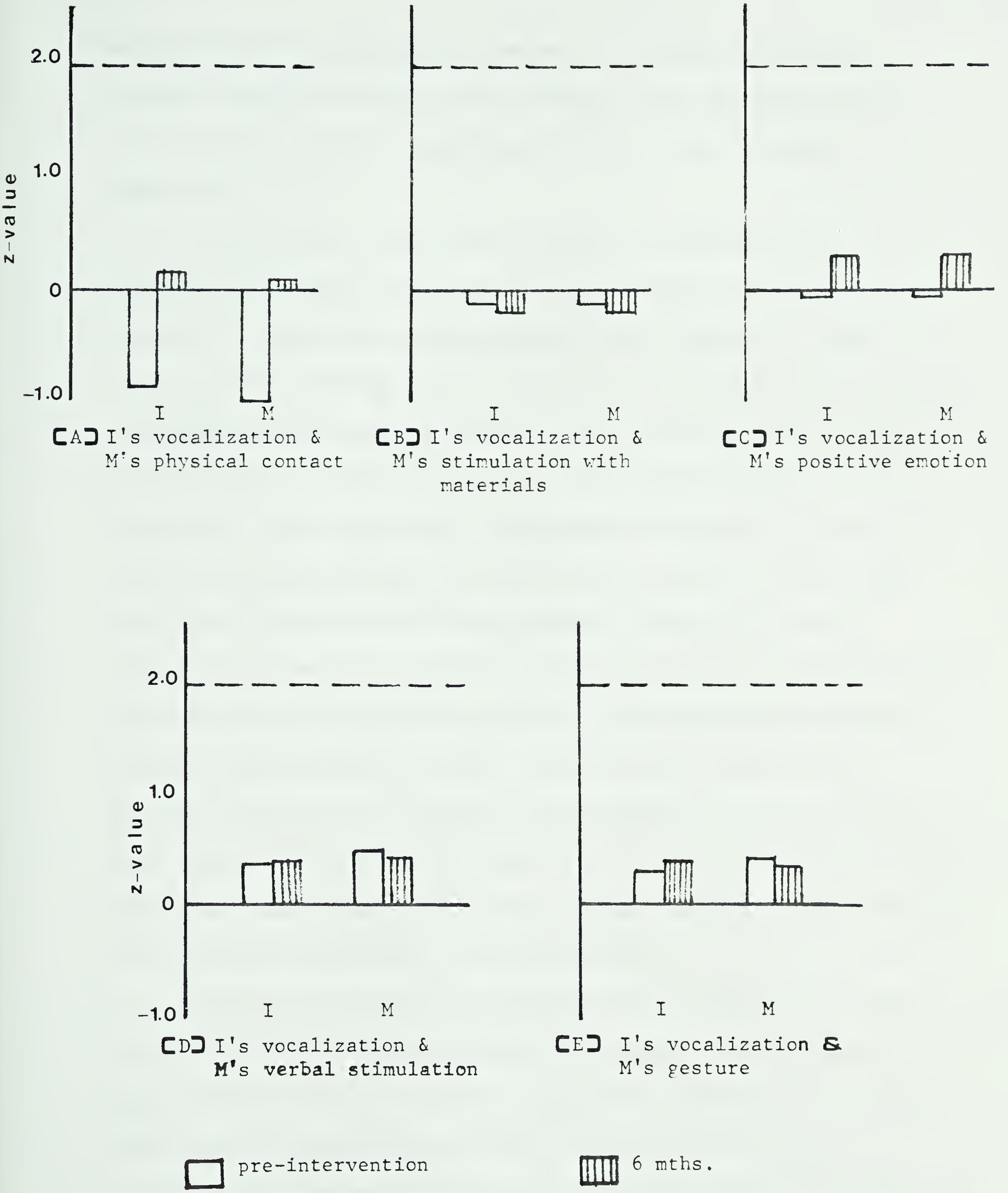

FIGURE 10: CO-OCCURRENCE OF INFANT'S VOCALIZATION WITH FIVE MOTHER BEHAVIOURS

months into intervention, however, a strong concurrent pattern had been established between the two behaviours ($z=1.56$ given mother behaviour; $z=1.36$ given infant behaviour).

A fourth pair showing increase in strength of co-occurrence over intervention were infant positive mother-directed behaviour and mothers' gestures. From inhibition levels of association, the co-occurrence of these two behaviours had by 6 months into intervention shot up to $z=1.02$ (given infant behaviour) and $z=0.92$ (given mother behaviour; see Figure 9D). As shown in Figures 10A and 10C infant vocalization had started to pick up a rather weak concurrent association with mothers' physical contact (Figure 10A) and with mothers' positive emotion (Figure 10C) after an initial weak association. Although the strength of co-occurrence between infant vocalization and mothers' physical contact at 6 months in intervention was obviously weak ($z=0.14$ given infant behaviour, and $z=0.09$ given mother behaviour; see Figure 10A) the change from $z=-1.04$ to $z=0.09$ (given mother behaviour) is considerable.

A drop in strength of co-occurrence occurred between infant positive mother-directed behaviour and mothers' physical contact over time (Figure 9A) and between infants' play activity and mothers' positive emotion (Figure 8).

Co-occurrences provide a picture of interaction and, in fact, do indicate which behaviours mother and infant tend to exhibit together. However, if two behaviours occur together

we may want to find out which of the two behaviours is eliciting or determining the other. The issue of causation was pursued utilizing a lag sequential analysis. The analysis reported here is based on lag 1 data only. That is, the analysis sought to answer the question: what happens in the next 10-second epoch following a given infant or mother behaviour? The choice of lag size is a difficult question. It is related to the answer to the question: how soon should one interactant's behaviour follow the other's criterion behaviour to assume a dependency relationship? To a very large extent the answer to this question would vary depending on the specific behaviours under consideration. Ten seconds after a criterion behaviour was deemed a reasonable time limit within which to expect a dependent response. This does not in any way imply, however, that longer time periods are not plausible.

The sequential analysis performed in this study involved, as in the analysis of co-occurrences, the comparison of predicted matching frequencies (Pred. M.F.) with observed matching frequencies(Obs M.F.). A predicted matching frequency is defined as the unconditional probability of the matching behaviour multiplied by the frequency of the criterion behaviour. The formula for arriving at the z-value for determining whether one behaviour follows another more frequently than the former's unconditional probability will predict is similar to the formula used in examining co-occurrences:

$$\frac{\text{Obs. M.F} - \text{Pred. M.F}}{\sqrt{\text{Pred. M. F.} \times q}}$$

where q = 1 minus the unconditional probability of the criterion behaviour.

Observed matching frequencies were obtained separately for each 2-minute observation session to avoid overestimation resulting from ignoring the boundaries between successive sessions. Adding matching frequencies over sessions produced the total observed matching frequency for an observation. However, predicted matching frequencies (Pred. M.F.) tended, naturally, to ignore the inter-session boundaries since they were computed from the total frequency of behaviours. Thus the Pred. M.F. tended to be overestimated and it is important to point out that this had the effect of diminishing the actual strength of dependency relationship between any two behaviours. Three categories of sequential dependencies were examined and the results obtained under each category are reported below.

Dependency of Mother behaviours on infant behaviours

Dependency of mother behaviours on infant behaviours was examined to answer research question 12, namely, what effect would intervention have on mothers' responsiveness to infant behaviours?

Three infant behaviours served as criteria for examining mother responsiveness. These were: infants' positive mother-directed behaviour, infants' activity with

TABLE 6A

DEPENDENCY OF MOTHER BEHAVIOURS ON INFANT BEHAVIOURS

Infant Behaviour	Mother Behaviour	z(pre-)	z(6mth)
Positive M-directed	Physical contact	0.51	0.55
"	Positive emotion	0.30	0.80
"	Verbal stimulation	0.23	0.20
Activity with materials	Stim. with materials	0.31	0.82
"	Positive emotion	-0.12	0.49
"	Verbal stimulation	-1.21	-0.34
Vocalization	Physical contact	-0.82	-0.27
"	Stim. with materials	-0.46	-0.22
"	Positive emotion	0.76	-0.64
"	Verbal stimulation	0.82	0.37
"	Gesture	0.32	0.48

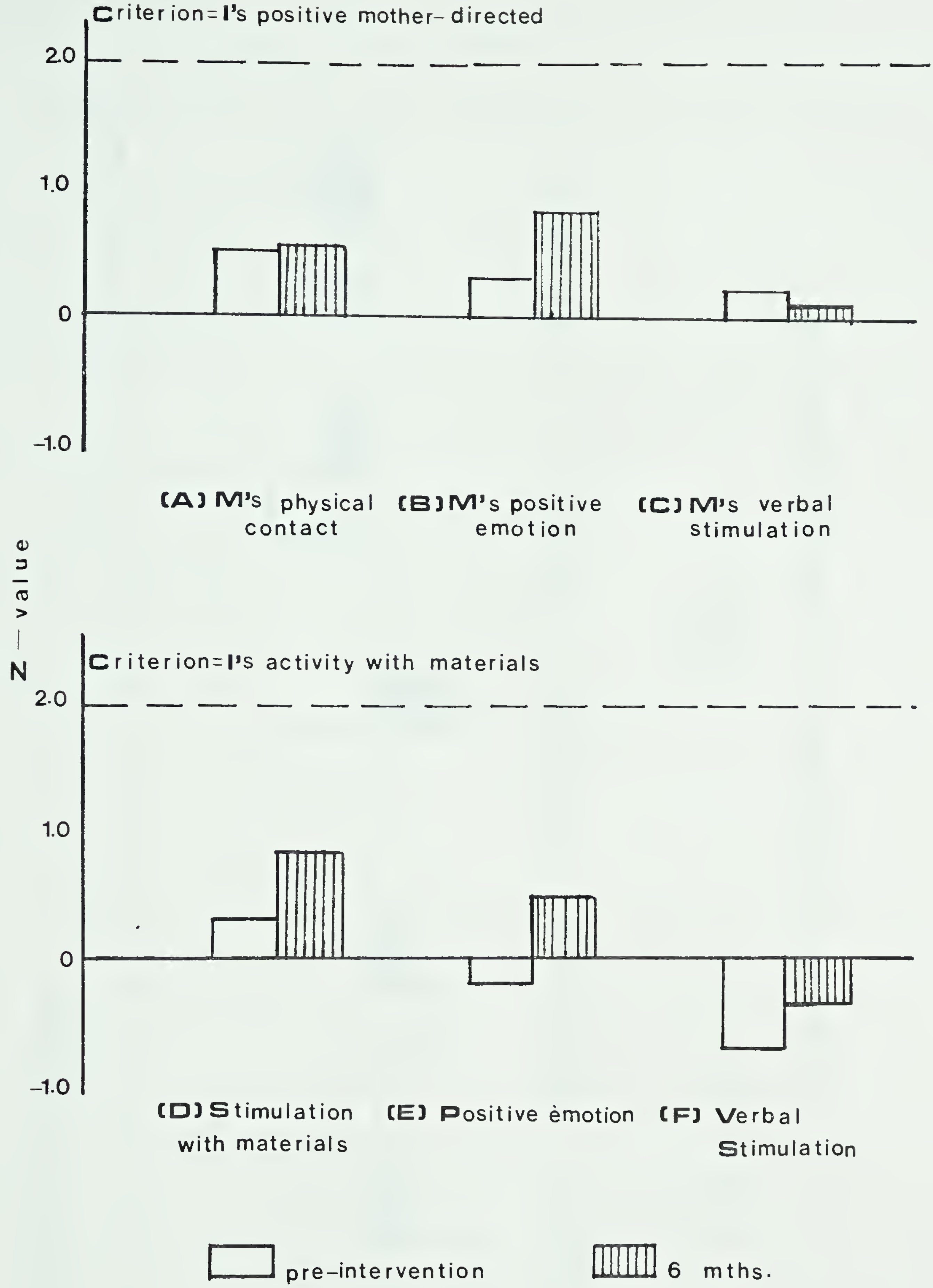

FIGURE 11: SEQUENTIAL DEPENDENCIES (1)

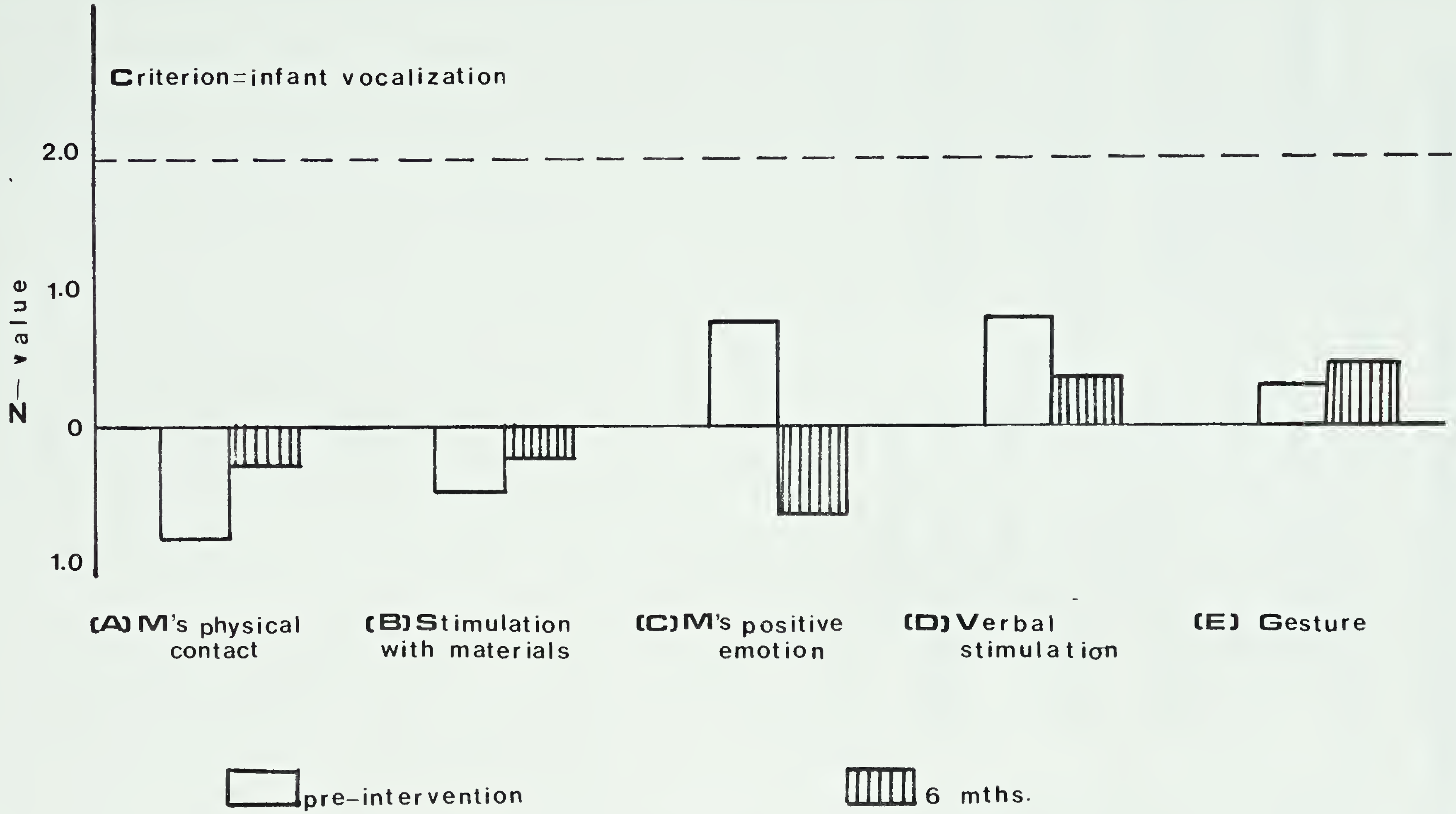

FIGURE 12: SEQUENTIAL DEPENDENCIES (2)

T A B L E 6B

DEPENDENCY OF INFANT BEHAVIOURS ON MOTHER BEHAVIOURS

Mother Behaviour	Infant Behaviour	z(pre-)	z(6mth)
Physical contact	Positive M-directed	0.23	-0.14
"	Vocalization	-0.41	0.03
Stim. with materials	Act. with materials	2.12	1.01
"	Vocalization	-0.44	0.11
Verbal stimulation	Positive M-directed	0.55	1.30
"	Vocalization	0.14	0.89

materials, and infants' vocalization. The extent to which mothers responded to infants' positive mother-directed behaviour was examined with regard to three mother behaviours. In Figure 11 graphs A, B, and C show three mother matching behaviours in relation to infant positive mother-directed behaviour. Although none of the sequential relationships exceeded its predicted level , it was possible to detect change in sequential relationships during intervention. Figure 11 (A, B, and C) shows that the only change worth considering occurred in the sequential relationship between infant positive mother-directed behaviour and mothers' positive emotion (Figure 11 B). From a pre-training level of z=0.30 the degree of dependency of mothers' positive emotion on infant positive mother-directed behaviour increased to z=0.80 (Table 6A). Thus by 6 months into intervention mothers were reinforcing infants' positive mother-directed behaviour more than they did at the start of the programme. The degree to which infants' mother-directed behaviour elicited mothers' physical contact did not change over intervention. There was a slight drop in the already low level of dependency of mothers' verbal stimulation on infants' positive mother-directed behaviour.

Next to be considered was the extent to which infants' activity with materials elicited three different mother behaviours, namely: mothers' stimulation with materials, mothers' positive emotion, and mothers' verbal stimulation. The dependency of mothers' stimulation of infants with

materials on infants' activity with materials increased from z=0.31 to z=0.82 (Figure 11D; and Table 6A). While infants' play activity was somehow 'inhibiting' mothers' positive emotion at the start of the programme, by 6 months into intervention this infant behaviour was moderately eliciting mothers' positive emotion (Figure 11E). This indicated more reinforcement of infants' play behaviour. Infants' play activity and mothers' verbal stimulation did not seem to show any positive sequential relationship (Figure 11F).

Infant vocalization was also examined in relation to mothers' physical contact, stimulation with materials, positive emotion, verbal stimulation and gesture. As Figure 12 shows no positive sequential relationship existed between infant vocalization and mothers' physical contact, and stimulation with materials respectively. However, there was some decrease in the 'inhibitive' relationship between this infant behaviour and the two mother behaviours respectively. Two mother behaviours that were occurring in response to infant vocalization dropped their degree of dependency. By 6 months into intervention mothers' positive emotion had not only ceased to be fairly dependent on infant vocalization; the positive sequential relationship had changed into an 'inhibitive' one (Figure 12C). The degree of dependency of mothers' verbal stimulation on infant vocalization dropped from z=0.82 to z=0.37. The only mother behaviour which showed a slightly increased dependency on infant vocalization was gesture. Figure 10E on the co-occurrence

data also showed that given infant vocalization the tendency for mothers' gesture to occur in the same time interval increased slightly during intervention.The two sets of data thus indicate increased tendency for mothers to respond to infant vocalization with gestures.

Dependency of infant behaviours on mother behaviours.

Dependency of infant behaviours on mother behaviours was examined to answer research question 13: **what effect would intervention have on infants' responsiveness to mother behaviours?**

A drastic drop occurred in the strength of dependency of infants' activity with materials on mothers' stimulation with materials (Figure 13B). Before parent training infant play activity was a significant response to mothers' stimulation with materials ($z=2.12$). However, by 6 months into intervention this dependency had diminished to $z=1.01$. What this trend and the trend shown in Figure 11D depict is that while it was mothers who tended to stimulate play activity before intervention, by 6 months into intervention mothers' stimulation of play activity was a response to infants' initiation of play activity. This may thus be an indication that infants were more active at play as a result of intervention than they were before.

The major increase in infant responsiveness to mother behaviour occurred in relation to mothers' verbal

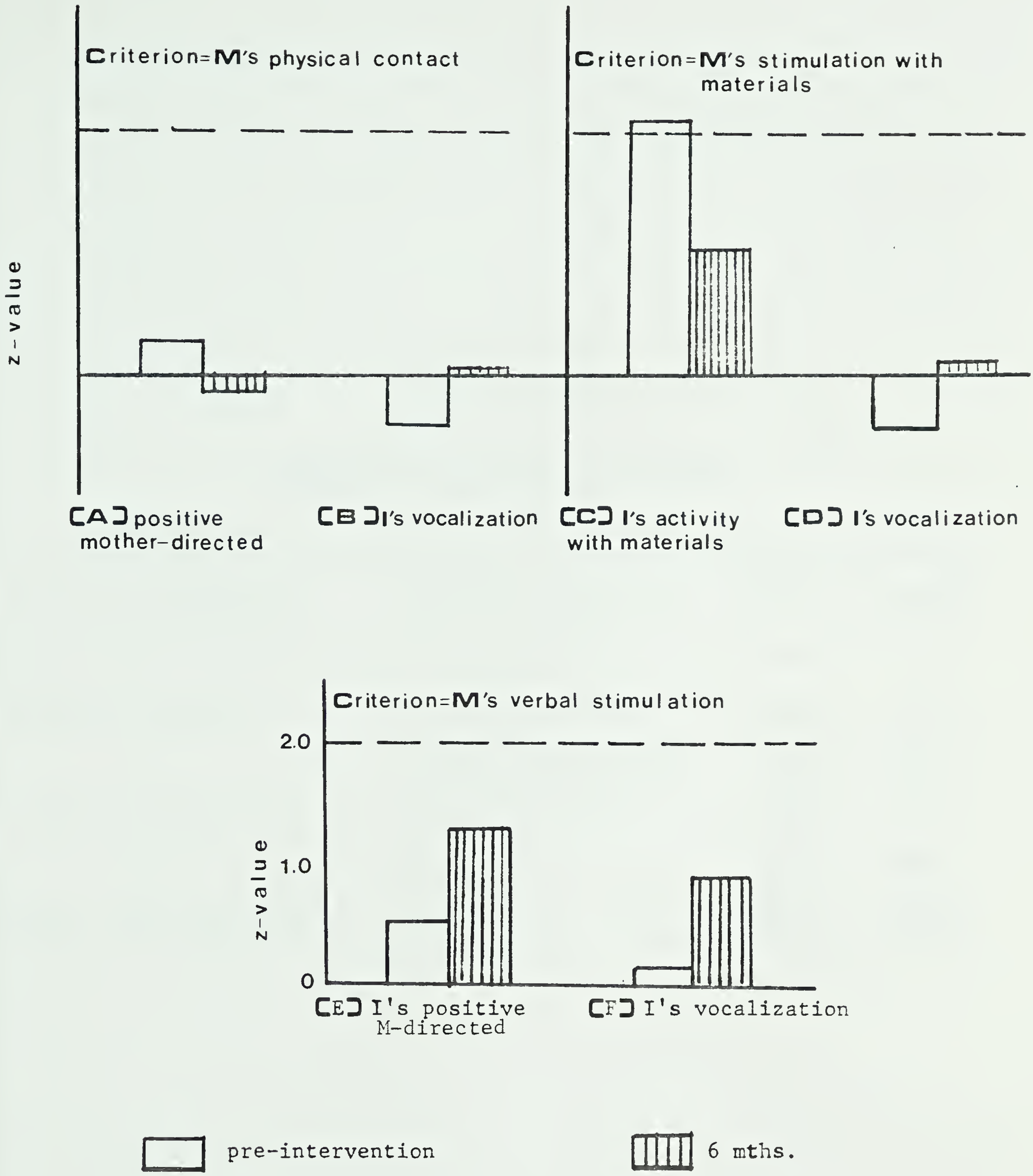

FIGURE 13: SEQUENTIAL DEPENDENCIES 3

TABLE 6C

SEQUENCES IN MOTHER BEHAVIOURS

Criterion Behaviour	Matching Behaviour	z(pre-)	z(6mth)
Physical contact	Positive emotion	0.08	1.04
"	Verbal stimulation	0.58	0.35
Verbal stimulation	Positive emotion	0.45	1.36
"	Gesture	0.31	0.81
Stim. with materials	Gesture	-0.67	0.58

stimulation. There were sharp increases in infants' positive mother-directed behaviour (Figure 13D) and vocalization (Figure 13E) as a response to mothers' verbal stimulation ($z=0.55$ to $z=1.30$ and $z=0.14$ to $z=0.89$ respectively). A comparison of the co-occurrence and sequential dependencies data showed that while virtually no change occurred in the tendency for mother's verbal stimulation and infant vocalization to occur in the same time interval, the tendency for infant vocalization to occur in the next time interval increased very considerably. A similar pattern of change was found for mothers' verbal stimulation and infant positive mother-directed behaviour.

Sequential relationships between pairs of mother behaviours.

To answer research question 14: **what change would take place in the sequential relationships between pairs of selected mother behaviours as a result of intervention?**, three crucial mother behaviours were examined in relation other mother behaviours which tended to immediately follow them.

The three criterion mother behaviours were physical contact, verbal stimulation, and stimulation of infant with materials. The data showed that positive emotion and verbal stimulation tended to follow physical contact more often than any other mother behaviour. Changes occurring in the dependency of these two behaviours on positive emotion were therefore examined. Figure 14A shows that over the

intervention period there was a sharp increase in the dependency of positive emotion on physical contact ($z=0.08$ to $z=1.04$) while the dependency of verbal stimulation on physical contact dropped. Thus mothers tended to show positive emotion after establishing physical contact with their infants more often than they did other behaviours.

Second, mother behaviours were examined for behaviours immediately following verbal stimulation. The behaviour that was most likely to follow verbal stimulation by 6 months into intervention was positive emotion. Gesture was the next most likely behaviour to follow verbal stimulation. Both behaviours showed sharp increases in strength of dependency over intervention (Figures 14C and 14D).

Third, changes in dependencies of other mother behaviours on stimulation of infant play activity were examined. Only one sequential dependency showed a pattern of change worth noting.From a fairly weak association mothers' use of gesture was more frequently following stimulation with materials by 6 months into intervention (Figure 14E).

The sequential dependencies between pairs of mother behaviours throw some light on mothers' interaction and teaching strategies over time. Figure 14 shows that mothers showed increased use of physical contact for social and emotional stimulation. The increased use of positive emotion

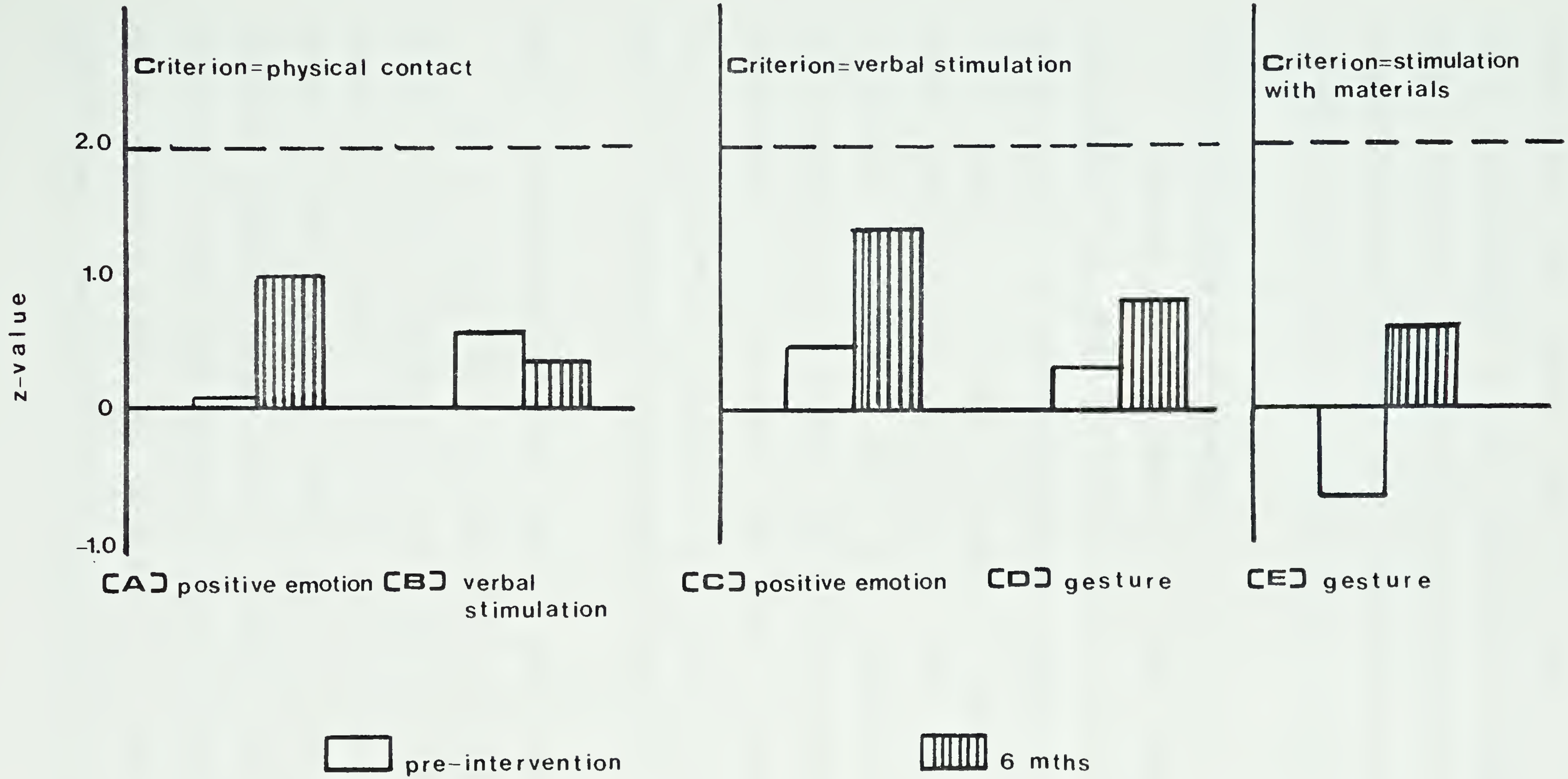

FIGURE 14: SEQUENTIAL DEPENDENCIES IN MOTHER BEHAVIOURS

immediately after verbal stimulation may reflect increased use of reinforcement in the teaching of language and other skills. Finally, the increase in the sequential dependency of gesture on stimulation with materials may depict increased use of physical demonstration and/or guidance.

Infant Developmental Progress

To demonstrate the effects of intervention on the developmental progress of the infants in the study the Bayley Scales of Infant Development (BSID) were administered three times at an average interval of 3 months. Table 7 reports the Mental Development Index (MDI) scores and the Psychomotor Development Index (PDI) scores with their age equivalents for all infants. The mean age equivalents of both MDI and PDI scores are reported at the bottom of the table. Developmental progress in both mental and motor domains is graphically displayed in Figure 15.

Would intervention enhance infants' mental development?

Table 7 shows that the mean mental developmental index showed slight increases over intervention although these increases were not statistically significant. In terms of age equivalents, however, there was a 3 to 8 months range of increase (Mean=5.5 months) over 7 months. One infant manifested a more than normal rate of development. The mean age equivalents on the MDI were 6.2, 8.8, and 11.7 months at pretraining, 3 months into intervention and 7 months into

intervention respectively. The corresponding mean CAs were respectively, 8.5, 11.8, and 15.6 months. The increase in mental age equivalent of 5.5 months over 7 months show a mental development rate of 78%. It is also important to point out that the mean mental age of 11.7 months is very high for a group of moderate to severely retarded infants with a mean CA of 15 months. Carr (1975) found a mean mental age of 9.26 and 7.49 months respectively for home-reared and boarded-out Down's syndrome infants of similar chronological age not receiving intervention. This suggests superiority in mental functioning of the infants in this study over a non-intervention age-matched group.

Would intervention enhance infants' physical development and functioning?

Developmental progress data in the motor domain are also reported in Table 7. There was a slight, statistically non-significant decline in the mean Psychomotor Developmental Index over intervention. Considering the age equivalents, there was an average increase of 4.8 months in motor age over the 7-month period (Range=3 to 6 months) reflecting 69% rate of development. The mean age equivalents of the PDI were 5.7, 8.2, and 10.5 months at pre-training, 3 months into intervention, and 7 months into intervention respectively. While mental development appears to have been more enhanced than motor development, the motor age equivalents found in this study are, once again, higher than

TABLE 7

BAYLEY SCORES AND AGE EQUIVALENTS
OVER THREE ASSESSMENTS

Asst.#	1		2		3		1		2		3	
Infant #	MDI	AGE	MDI	AGE	MDI	AGE	PDI	AGE	PDI	AGE	PDI	AGE
01	103	9	83	11	75	12	83	8	58	9	90	14
02	60	6	60	9	75	12	70	6	58	9	73	11
03	50	10	70	15	76	18	46	9	52	10	53	14
04	50	5	56	6	64	12	57	5	78	9	61	10
05	40	3	48	6	33	7	38	3	44	6	30	6
06	76	4	65	6	59	9	70	3	54	6	50	8
MEAN AGE	6.2		8.8		11.7		5.7		8.2		10.5	

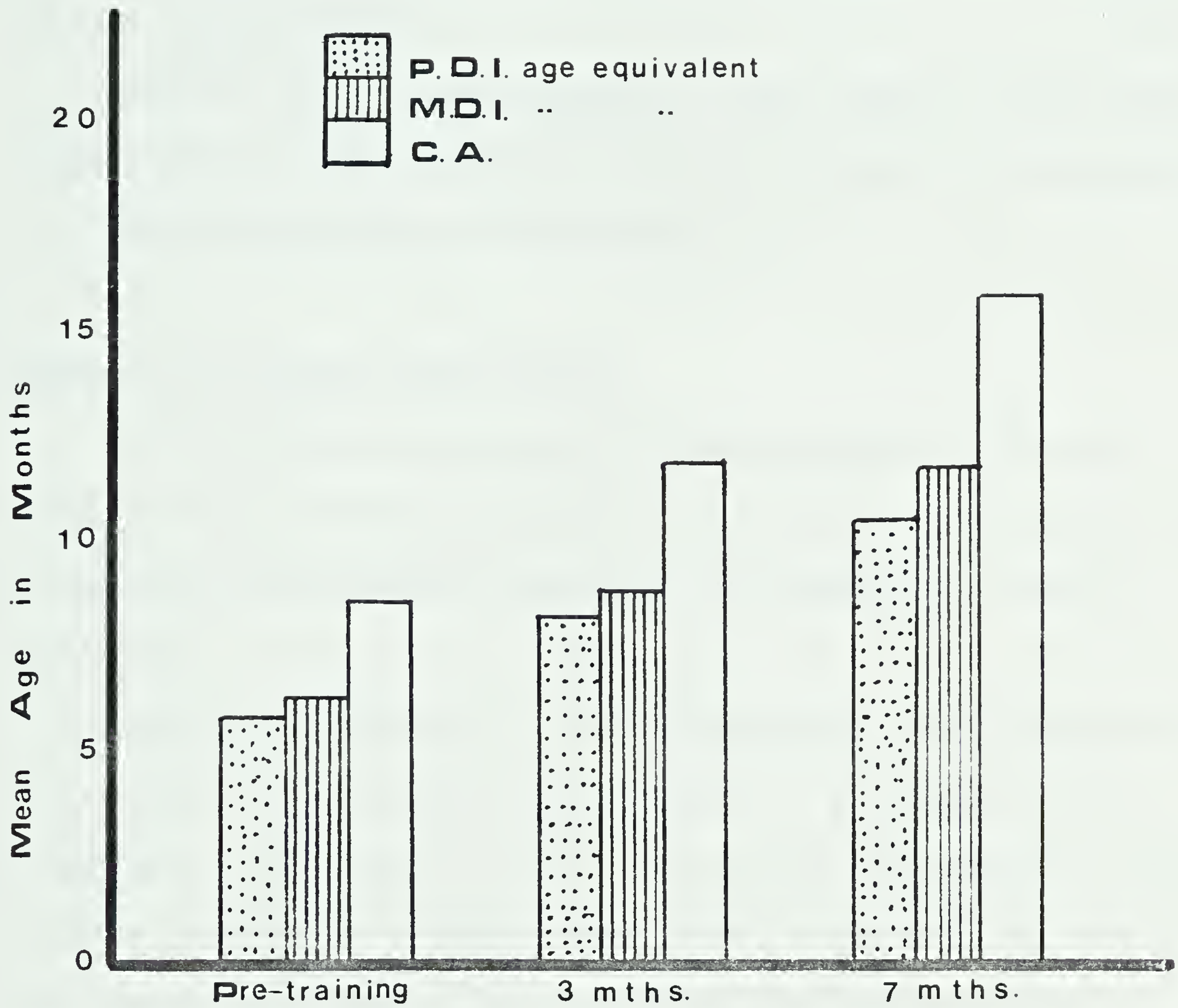

FIGURE 15: MENTAL AND MOTOR GROWTH IN RELATION TO C.A.

motor age equivalents reported for the infants in Carr's study. As compared to a motor age of 10.5 months in this study Carr's home-reared and boarded-out Down's syndrome infants had an average motor age equivalent of 8.35 and 6.77 months respectively.

Table 7 also shows, however, that despite the overall significant group progress infant 05 showed no progress in the last four months of intervention.

Index of Programme Efficiency

In relation to the rate of development of normal infants how efficient would the intervention programme be in promoting developmental progress in severely retarded infants?

Since the concern of the study was also to examine the efficiency of intervention in terms of promoting child progress, individual as well as group developmental progress made on the Bayley Scales were used to compute an index of programme efficiency. The notion of an intervention efficiency index (IEI) was first developed by Simeonson and Weigerink (1975). Arguing, inter alia, that the index proposed by Simeonson and Weigerink (1975) did not account for time spent in intervention, Bagnato and Neisworth (1980) proposed a formula for the computation of an intervention efficiency index (IEI) which takes cognizance of the functional relationship between time spent in programme and developmental progress.

The approach proposed by Bagnato and Neisworth (1980) has been adopted in this study to measure programme efficiency. The IEIs reported in this study are based on two variables, namely: (a) an index of developmental gain in months (obtained from pre- and post-tests), and (b) length of participation in intervention expressed in months. The IEI is then defined as the ratio of variable (a) to variable (b). Individual as well as group IEIs were calculated separately for the mental and motor domains of the Bayley scales.

Table 8 displays individual and group IEIs derived for the period between assessment 1 and assessment 3 (the entire study period). Also reported are the length of time each infant had spent in intervention by the final assessment, the mental (MDI) and motor (PDI) scores at assessments 1 and 3 and their age equivalents, as well as the gain scores in months.

The mean IEIs reported at the bottom of Table 8 show that as a group the infants achieved 78% of the normal rate of mental development by the time they had received 7 months of intervention (range=48% - 111%). The rate of development in the motor domain was 70% (range=49% - 96%). In mental development one infant achieved a more than normal rate of development (IEI=1.11). The infant who showed the least rate of development in the mental domain (48%) manifested the largest rate of development in the motor domain (96%). This infant's minimal progress in mental development may be

T A B L E 8

CHILD DEVELOPMENTAL PROGRESS AND PROGRAMME EFFICIENCY
AS MEASURED BY THE B.S.I.D

		MENTAL DEVELOPMENT INDEX						PSYCHOMOTOR DEVELOPMENT INDEX					
Inf.	*Time (mths)	Pre-	Age	Post	Age	Gain (mths)	IEI	Pre-	Age	Post	Age	Gain (mths)	IEI
01	6.25	103	9	75	12	3	.48	83	8	90	14	6	.96
02	6.45	60	6	72	12	6	.93	70	6	73	11	5	.78
03	7.20	50	10	76	18	8	1.11	46	9	53	14	5	.69
04	8.80	50	5	64	12	7	.80	57	5	61	10	5	.57
05	6.09	40	3	33	7	4	.66	38	3	30	6	3	.49
06	7.29	76	4	59	9	5	.69	70	3	50	8	5	.69
Means	7.01					5.5	.78					4.83	.70

*Time represents length of time spent in intervention

TABLE 9

CHILD DEVELOPMENTAL PROGRESS AND PROGRAMME EFFICIENCY DURING FIRST 3 MONTHS OF INTERVENTION

		MENTAL DEVELOPMENT INDEX						PSYCHOMOTOR DEVELOPMENT INDEX					
Inf*	Time (mths)	Pre-	Age	3mth	Age	Gain (mths)	IEI	Pre-	Age	3mth	Age	Gain (mths)	IEI
01	3.06	103	9	83	11	2	.65	83	8	58	9	1	.33
02	3.48	60	6	60	9	3	.86	70	6	58	9	3	.86
03	3.23	50	10	70	15	5	1.55	46	9	52	10	1	.31
04	3.48	50	5	56	6	1	.29	57	5	78	9	4	1.15
05	2.77	40	3	48	6	3	1.08	38	3	44	6	3	1.08
06	3.42	76	4	65	6	2	.58	70	3	54	6	3	.88
$\bar{X}$	3.24					2.67	.84					2.5	.77

*Time represents length of time spent in intervention

TABLE 10

CHILD DEVELOPMENTAL PROGRESS AND PROGRAMME EFFICIENCY DURING LAST 4 MONTHS OF INTERVENTION

INDEX		MENTAL DEVELOPMENT INDEX						PSYCHOMOTOR DEVELOPMENT					
Inf.	*Time (mths)	3mth	Age	7mth	Age	Gain (mths)	IEI	3mth	Age	7mth	Age	Gain (mths)	IEI
01	3.19	83	11	75	12	1	.31	58	9	90	14	5	1.57
02	2.97	60	9	75	12	3	1.01	58	9	73	11	2	.67
03	3.97	70	15	76	18	3	.76	52	10	53	14	4	1.01
04	5.32	56	6	64	12	6	1.13	78	9	61	10	1	.19
05	3.32	48	6	33	7	1	.30	44	6	30	6	-	-
06	3.87	65	6	59	9	3	.78	54	6	50	8	2	.52
$\bar{X}$	3.77					2.83	.72					2.33	.66

*Time represents length of time spent in intervention

explained by her exceptional preintervention performance on the mental scales. Unlike all the other infants whose mental age equivalent on assessment 1 fell below their CA, this infant equalled her CA on the first assessment, showing normal mental development. Given this high initial performance very minimal gain could be expected during intervention.

It is also important to note that the low lower end of the range in motor development (49%) may be explained by the fact that the infant at the lower end of the range did not show any developmental gain in the last four months of intervention (see Table 10).

Rates of development in the first three months and the subsequent four months of the programme were also compared to find out whether intervention was equally effective in both phases. This was necessary in examining the short-term impact of parent-training relative to its long-term effects. Table 9 reports individual and group IEIs in the first 3 months of intervention while Table 10 displays IEIs for the subsequent four months. The mean rate of mental development dropped from 84% to 72% while that of motor development dropped from 77% to 66%. These declines were, however, not statistically significant.

Home Environment

What effect would intervention have on the physical and emotional environment of the home?

Changes in the quality and quantity of the social, emotional, and cognitive support available to infants as measured on the H. O. M. E. have been plotted in Figure 16. Figure 16A reflects means for the entire group of 6 infants while in Figure 16B only four infants are represented. Detailed scores for each infant on each of the subscales are reported for all assessments in Appendix G. As Table 11 shows two of the infants (01 and 02) attained ceiling scores on the first administration (scores on the 0 - 3 years version of the H. O. M. E. range from 0 to 45) and maintained these high scores throughout later assessments. For these two infants it was impossible to expect improvement in the quality and quantity of social, emotional, and cognitive support and therefore in assessing overall change in home environment for the entire group the two infants attaining ceiling scores were dropped from the analysis. This was necessary because their unchanging scores confounded overall change.

The repeated measures analysis of variance reported in Table 12 shows an overall significant increase in the quality and quantity of social, emotional, and cognitive support available to the infants over the intervention period ($F=5.97$; $p<.05$). The post hoc comparison of means showed that apart from the overall significant increase from

TABLE 11

TOTAL H.O.M.E. SCORES BY TIME INTO INTERVENTION

Infant	Pre-int.	3mths.	7mths.
01	44	44	44
02	45	45	45
03	33	33	40
04	37	40	44
05	23	18	29
06	28	37	37
Mean (n=6)	35.00	36.17	39.83
Mean (n=4)	30.25	32.00	37.50

TABLE 12

MEAN H.O.M.E. SCORES BY TIME INTO INTERVENTION

H.O.M.E. subcales	pre-int	3mths	6mths	F(2,6)
Emotional & verbal responsivity of M.	7.50	8.75	9.50	1.12
Avoidance of restriction & punishment	6.75	6.50	6.25	1.00
Org. of physical&temporal environment	5.50	4.25	5.25	2.00
Provision of approp. play materials	5.50	6.25	8.75	5.15*
Maternal involvement with child	3.50	4.25	5.75	2.91
Opportunities for variety in stim.	1.50	2.00	2.00	0.43
TOTAL HOME SCALE	30.25	32.00	37.50	5.97*

* $p<.05$

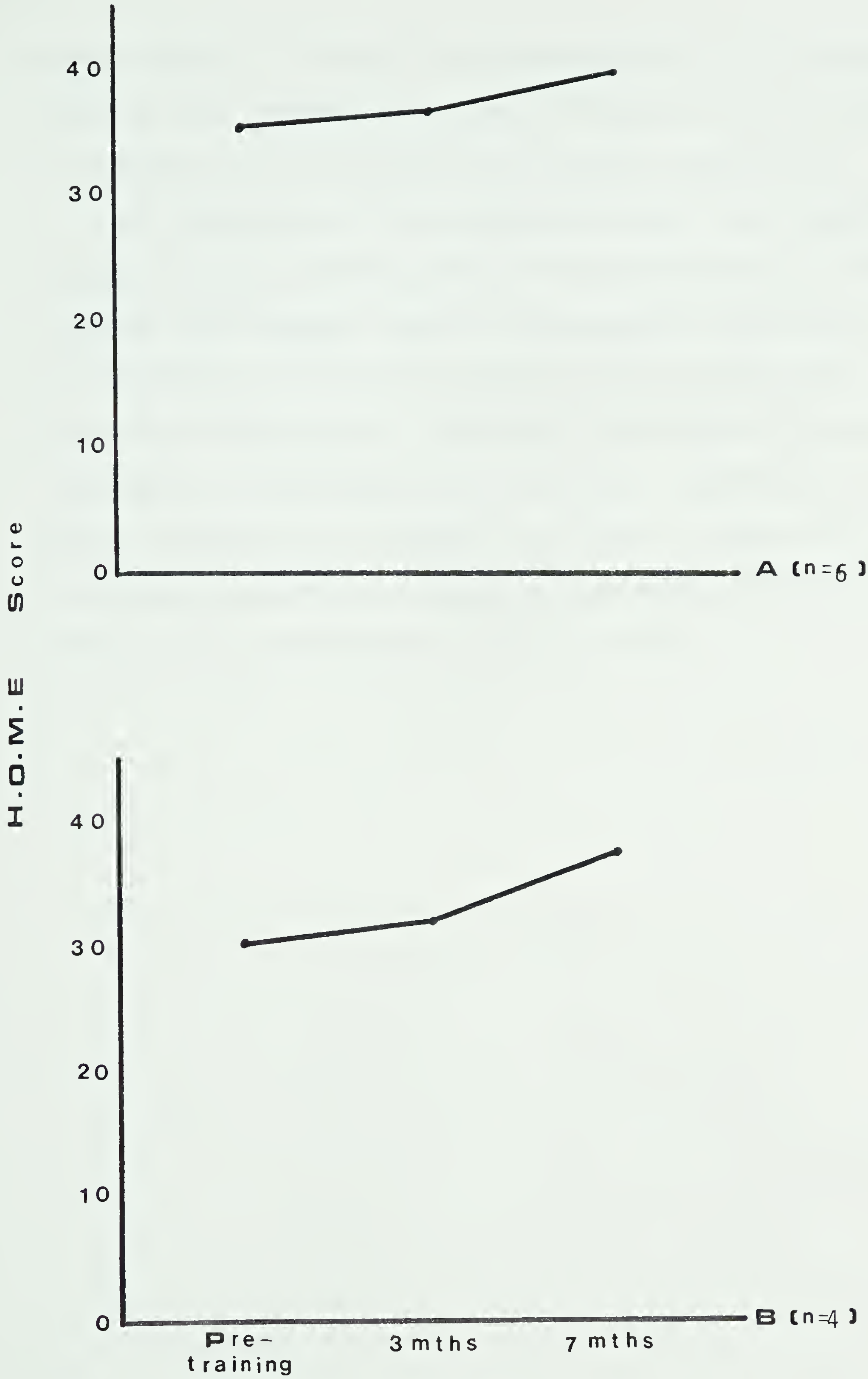

FIGURE 16: CHANGE IN QUALITY OF HOME ENVIRONMENT

pre-training to 7 months into intervention, the change in the last four months (i.e. from 3 months into intervention to 7 months into intervention) was also significant.

An inspection of the subscale scores (see Appendix G) showed that considering either the entire group or the four infants, the biggest overall improvements occurred, by order of importance, in the provision of appropriate play materials (subscale IV), maternal involvement with child (subscale V), and emotional and verbal responsivity of mother (subscale I). However, as Table 12 shows only the increase in provision of appropriate play materials was statistically significant ($F=5.15$; $p<.05$).

SIX: DISCUSSION

The results of the study generally portray the home component of the Early Education Programme as a recommendable intervention model for families with moderately to severely retarded infants. Discussion of the results of the study is done with the caution that while a number of significant gains were found, not all gains could be attributed to intervention in light of several plausible competing hypotheses. The overall results of the study will be discussed in the same format as the presentation of results, namely: mother-infant interaction, infant developmental progress/general intervention efficiency, and home environment.

Mother-infant interaction

Significant changes were demonstrated in three mother behaviours. First, by 6 months into intervention mothers' attention to infants' physical needs had reduced tremendously ($p<.05$). Second, there was an even more drastic decline in mothers' physical contact with their infants ($p<.01$). These two findings are consistent with results of other studies examining interaction between mothers and their normal infants. Pain (1980) reported that all maternal actions toward their infants declined significantly from 3 to 9 months while Clarke-Stewart (1981) reported a decline

in mother-child physical contact and proximity between age 12 months to 30 months. Clarke-Stewart noted that the decline in physical contact was related to the children's increasing autonomy. Reduced maternal attention to infants' physical needs and reduced physical contact with infants appear, then, to be a function of growing independence and increased mobility of infants. By 6 months into intervention the infants were 14.5 months on the average and were expected as a result of intervention to be already walking or at least crawling and therefore more mobile and more independent of their mothers. The consistent increase in infants' mobility (going from place to place) from .6% to 4.1%, although statistically non-significant, lends more support to the assertion that the decline in the two mother behaviours can be attributed to increased mobility and independence in the infants.

An extensive longitudinal study done in England (Carr, 1975) on developmental differences between home-reared and boarded-out Down's syndrome children not receiving intervention provides useful developmental data for purposes of comparison. Carr followed the infants in her study from their first month to age 48 months and used the Bayley Scales of Infant Development in assessing mental and motor developmental status at 7 different time points. In all, 45 children made up of 39 home-reared and 6 boarded-out were studied to the end of the study.

In fact while less than half of Carr's home reared infants were crawling at age 15 months, all 6 infants in this study were crawling by age 15 months. Thus the significant decline in the two mother behaviours (attending infant's physical needs and physical contact) may have signified efficacy of the intervention programme to enhance developmental functioning.

The third significant finding with regard to mother behaviours was the increased use of gestures during intervention. The substantial increase in the use of gestures was very much an expected outcome of this kind of intervention. The parent training model employed in the programme taught mothers to test and teach the acquisition of skills utilizing five levels of prompting. Physical guidance and modelling were important components of this teaching model. The increased use of gestures found in this study may be indicative of mothers' implementation of the teaching strategies imparted to them during parent training. It is important to point out here that mothers' informal assessments of the value of the programme to them indicated that while gestures formed a good part of their day-to-day interaction with their children, the five-level model of instruction equipped them with further skills. The results showed further that the biggest increase occurred in the last three months of intervention, supporting the possibility of maintenance and generalization of physical teaching strategies beyond the parent training situation.

Intervention appears to have had an even more pronounced impact on infant behaviours than on mother behaviours. Two infant behaviours demonstrated statistically significant changes over intervention while change in three others came close to attaining statistical significance. There was a significant decline in infants' display of positive mother-directed behaviours ($F=4.15$; $p<.05$). The results showed that the reduction in positive mother-directed behaviours occurred at the same time that play with materials was increasing. The infants were 12 months old and were beginning to pay more attention to play objects than to their mothers.

What is difficult to explain, though, is that by 6 months into intervention infants' activity with materials had dropped off to below baseline levels of occurrence. One would have expected that play activity would be even more pronounced at this time. However, it was still clear that positive mother-directed behaviours and activity with materials were somehow inversely related. This trend lends further support to an earlier suggestion that the decline in positive mother-directed behaviours may be an indication of increased involvement and preoccupation with play materials.

There is the need to sound a note of caution here in the interpretation of this finding. While the programme may have led to reduced infants' display of positive mother-directed behaviours, this may only imply that greater preoccupation with play objects, increased mobility, and

growing independence, reduced the opportunity to exhibit more positive mother-directed behaviours. This qualification is important in light of the finding that despite the significant decline, positive mother-directed behaviours were the second most dominant infant behaviour after play activity by 6 months into intervention.

Infant vocalization also showed a significantly sharp increase ($p<.01$) by 6 months into intervention. This change was very much anticipated in view of the programme's heavy emphasis on the development of cognition, language, and communication. This increase in infant vocalization may be associated with the increased maternal verbal stimulation during infants' play as shown by the co-occurrence and lag sequential data.

Two other key infant behaviours that manifested close to statistically significant increase were mobility ($p=.13$) and expressive physical behaviours ($p=.08$). In view of the small sample size these levels of significance are noteworthy. The increase in mobility, as noted earlier, is consistent with the reduction in mothers' physical contact and infants' positive mother-directed behaviours as well as with the significant improvement in motor functioning as demonstrated on the Bayley Scales of Infant Development. The increase in expressive physical behaviours may reflect increased use of nonverbal expressions of physical and emotional state as well as nonverbal communication including pointing and reaching for objects.

The changes in the quality of mother-child interaction were even more reassuring. The analysis of concurrent and sequential patterns in mother-infant interaction showed overall improvement in the quality of interaction and also confirmed some of the changes in specific mother and infant behaviours as being more the result of intervention than of any extraneous factor such as maturation.

The biggest qualitative change occurred in the co-occurrence of infants' play activity with mothers' verbal stimulation. Before intervention the relationship between these two behaviours was one of inhibition. However, by 6 months into intervention the two behaviours were co-occurring at a very high rate. This finding is significant for a number of reasons. First it confirms the significant increase in infant vocalization as resulting from improved quality of maternal verbal stimulation. Mothers were taking more advantage of infants' play activity to stimulate verbalization. Second, it also indicates that although mothers' verbal stimulation of their infants did not show a significant increase as expected, the impact of intervention may have been more on the quality rather than the quantity of verbal stimulation.

A second important finding was the increased relationship between infants' play activity and mothers' stimulation of infants with materials. As expected there was a substantial increase in the co-occurrence of the two behaviours. In fact they were the only pair of maternal and

infant behaviours that seemed to be co-occurring at a frequency higher than their unconditional probabilities would predict. The analysis of sequential dependencies also revealed that by 6 months into intervention mothers were responding more than before to infants' play activity by stimulating them with materials. Thus, again, although no significant change was evidenced in the quantity of mothers' stimulation of their infants with materials the increase in mothers' responsiveness to their infants' play activity represents an appreciable qualitative change.

Third, the analysis revealed increased co-occurrence of infants' positive mother-directed behaviours and mothers' display of positive emotion. The lag sequential analysis also showed that mothers' positive emotion was a frequent response to infants' positive mother-directed behaviours, and also that during intervention there was an increase in mothers' tendency to respond to infants' positive mother-directed behaviours with positive emotion. This finding may probably reflect increased understanding and use by mothers of the behavioural strategy of positive reinforcement of infants' appropriate behaviours.

Fourth, there was increased co-occurrence of infants' positive mother-directed behaviours and mothers' gestures, suggesting the effective use of physical guidance and demonstration in gaining and/or maintaining the attention of infants.

The results showed, rather disappointingly, that mothers' verbal stimulation as a response to infant vocalization declined over intervention. The only maternal behaviour that showed some increase as a response to infant vocalization was gesture.

In relation to infant responsiveness the results showed increased infant responsiveness to mothers' verbal stimulation. Two infant behaviours showed increase as responses to mothers' verbal stimulation. These were positive mother-directed behaviours and vocalization. Increased vocalization in response to maternal verbal stimulation coupled with the significant increase in the quantity of infant vocalization may be indicative of the programme's effectiveness in promoting language learning.

An examination of sequential relationships in sets of mother behaviours revealed a number of interesting sequences. Over the intervention period mothers showed increased tendency to display positive emotion immediately after physical contact and verbal stimulation. This pattern reinforces the earlier finding that intervention may have equipped mothers with reinforcement strategies. After positive emotion, gesture was next as the behaviour most likely to follow verbal stimulation, once again indicating increased use of physical strategies. The increasing use of gesture as the most likely behaviour to follow stimulation with materials may reflect the use of infants' play activity as a teaching situation during which modelling,

demonstration and physical guidance constituted important teaching strategies.

Infant Developmental Progress/Intervention Efficiency

Results of the study showed that the intervention programme was effectvie in enhancing both mental and motor development. Comparing the findings in this study to findings made by Carr (1975) on moderately to severely retarded infants not receiving intervention, the infants in this study showed superior mental and motor age equivalents on the Bayley scales. While Carr's home-reared and boarded-out infants showed a mental age equivalent of 9.26 and 7.49 months respectively at age 15 months, the infants in this study manifested a mental age equivalent of 11.7 months at age 15 months. The motor age equivalents in Carr's study were respectively, 8.35 and 6.77 months while infants in this study showed a motor age equivalent of 10.5months. The superiority of the infants in this study to those in Carr's study supports the effectivess of the intervention programme in enhancing development.

This study, however, confirms Carr's finding that the mean motor scale scores of Down's syndrome children tend to be lower than the mean mental scale scores, at least up to 36 months. Thus while intervention may have generally enhanced both motor and mental growth it did not change the disparity between mental and motor growth patterns.

Through the use of the Intervention Efficiency Index (Bagnato and Neisworth, 1980) it was possible to assess the degree of programme efficiency in relation to the promotion of developmental progress. On the whole intervention resulted in a 78% rate of normal development being attained in the mental domain. The corresponding rate for motor development was 70%. While the difference in the degree of efficiency between the two domains was not statistically significant the higher rate of mental development was not unexpected in view of the programme's biased emphasis on cognitive development. Another partial explanation for this disparity in rates of mental and motor growth may lie in the fact that during the last four months of intervention one infant showed zero progress in motor development, thus bringing down the group mean. It may be additionally suggested that the disparity between rates of development in the two domains is consistent with our knowledge of mental and motor functioning namely, that generally mental development is relatively more susceptible to experiential variables than motor development.

Of crucial importance is the failure of this study to replicate the very popular finding of cumulative decline in the developmental functioning of this category of infants with age (Carr, 1975; Centerwall and Centerwall,1960; Cornwell and Birch, 1969; Dicks-Mireaux,1966; Melyn and White,1973; Share, Webb, and Koch,1961; Shipe and Shotwell,1965). In the study by Carr (1975) DIQs (the

equivalent of MDI on the experimental form of the Bayley scales) of both home-reared and boarded-out Down's syndrome infants started to decline after 6 weeks. In this study both the MDI and PDI remained stable throughout intervention. What this stability portrays in relation to the known developmental decline, perhaps, is that intervention succeeded in arresting whatever developmental decline there could have been in the first 15 months of the infants' life. This is consistent with Hayden and Haring's (1977) finding that at least up to 72 months intervention children showed improvement rather than decline.

Finally results of the developmental data showed that there was no difference between the immediate and long-term impact of intervention. This finding suggests that the effects of parent training were maintained beyond training.

Home environment

The results showed improvement in the quality and quantity of the social, emotional, and cognitive support available in the infants' home environment. Despite the fact that two infants obtained ceiling scores on the H.O.M.E. throughout intervention, thus making it difficult to assess change, a significant increase in the quality of the home environment was demonstrated. There was a significant increase in the provision of appropriate play materials in the homes of the infants while substantial improvements occurred in mothers' involvement with their infants as well

as in mothers' emotional and verbal responsivity. The results on the H.O.M.E. data were very consistent with the results of the analysis of mother-infant interaction. The examination of concurrent and sequential patterns revealed increased emotional and verbal responsivity of mothers as well as responsivity in terms of involvement with infants' play.

Summary

Despite the limitations of the study, some intervention effects, however minimal, have been demostrated in relation to infant developmental progress, mother-infant interaction, maternal behaviours and teaching skills, and the quality of the home environment.

It has been shown that the probabilistic approach to the analysis of interaction data yields useful information about the nature and quality of the relationships between sets of mother and infant interactive behaviours. Increased responsiveness of mothers to infants' play activity and infants' positive mother-directed behaviours was demonstrated. In the case of infants' play activity mothers' responsiveness took the form of increased stimulation with materials as well as verbal stimulation. Mothers also responded increasingly to infants' positive mother-directed behaviours with reinforcing positive emotion and gestures. Increasing infants' responsiveness to mother behaviours was also demonstrated. Generally infants responded to mothers'

verbal stimulation by vocalizing and by display of positive mother-directed behaviours. This increase in infants' vocal responses to mothers' verbal stimulation is consistent with the overall significant increase in infant vocalization. Bowlby (1969) has pointed out that maternal vocal responses stimulate infant vocalization, enhancing the value of interaction and proximity. The increase in infant vocalization, coupled with the increasing infant vocal responsiveness to mothers' verbal stimulation are significant intervention outcomes in light of this acknowledged importance of vocal behaviour in the mother-infant interactional system.

The value of concurrent and lag sequential analysis of mother-infant interaction is further attested to by the high degree of synchrony obtained between mother-child interaction results and results from analysis of the H.O.M.E. data.

this study has lent some support to the effectiveness of intervention in accelerating development in moderate to severely retarded children confirming several other findings (Bricker and Dow, 1980; Brassell, 1977; Clunies-Ross, 1979; Connolly and Russel,1976; Hayden and Haring,1977; Ludlow Allen,1979; Maisto and German, 1979, Ramey and Smith, 1977).

Finally, since the programme utilized parents in its implementation, it may be safe to suggest that parent training has been shown to be an effective intervention strategy in light of the gains reported namely, the

enhancement of infant development, the improvement in the quality of interaction, and the increase in the quality of the home environment. This is consistent with findings of studies that have investigated the benefit to severely retarded infants of training their mothers (e.g. Bidder, Bryant, and Gray,1975; Ludlow and Allen,1979).

It would have been interesting to examine how changes in the home environment as a whole as well as in specific home environmental variables will be related to infant performance variables. However, the small sample size rendered any such correlational exploration less meaningful. Other limitations of this study have already been highlighted in Chapter One and will not be repeated here. However a few suggestions on the mother-child behavioural interaction system will not be out of place. It became apparent during data analysis that not only did the categories lack exclusivity but also that some categories were so broad with regard to the specific behaviours they encompassed that it was not always easy to interpret change. More exclusive and specific behaviour categories are required if higher levels of statisitical analysis are to be meaningful.

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A P P E N D I C E S

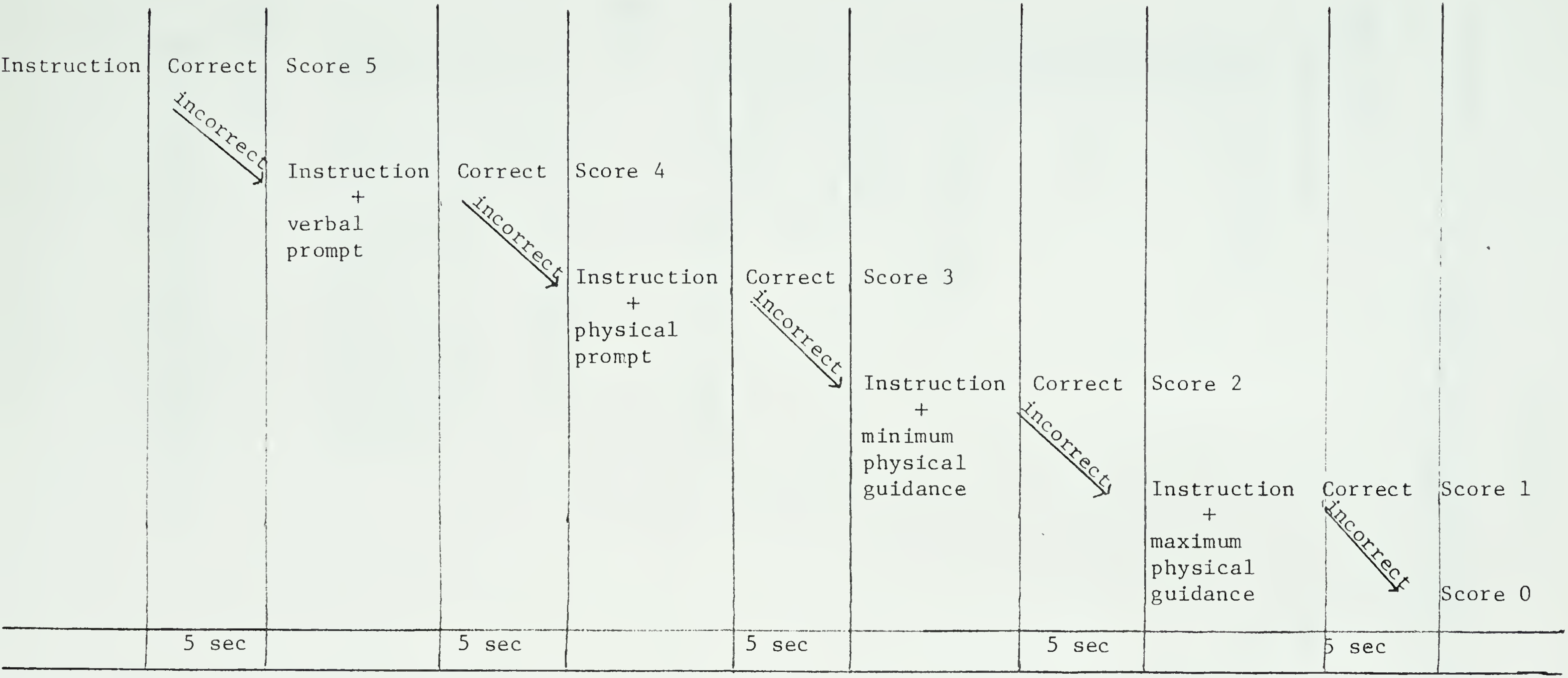
A - H

APPENDIX A

THE EARLY EDUCATION PROGRAMME: LEVELS OF PROMPTING*

LEVEL	5	INSTRUCTION		
"	4	INSTRUCTION	+	Verbal Prompt
"	3	INSTRUCTION	+	Physical Prompt
"	2	INSTRUCTION	+	Minimum Physical Guidance
"	1	INSTRUCTION	+	Maximum Physical Guidance

*See Appendix B for how the above levels utilized in teaching also fit into the assessment model



APPENDIX B SCHEMATIC MODEL OF ASSESSMENT AND SCORING PROCEDURE

APPENDIX C

A SAMPLE OF THE CONTENT OF INSTRUCTION (DIRECT TEACHING) IN FOUR DEVELOPMENTAL DOMAINS.

COGNITION

A. *Operations:*

reach and grasp
take out
put in
put on
push
pull
take off
take out
open
close
put on
find hidden face
find hidden object
give
build tower
build house
stack blocks
puzzle
looks at hand
attending
eye tracking
reach for stationary object

B. *Body awareness*

point to:
eyes
mouth
nose
hair

MOTOR

sitting back supported
sitting, self-supported
creeping
pull to stand
get up (crawl position)
roll from back to stomach
walk with stationary object
walk with finger assistance
walk with 2 hand assistance
walk with 1 hand assistance

SELF-HELP

drink from bottle unassisted
drink from cup/glass unassisted
eat with spoon unassisted

toilet training

LANGUAGE

Expressive:	*Receptive:*
baba	want up?
dada	give
mama	come here
pat-a-cake	want drink?
ball	wank cookie/toy?
Teddy	point to hat
nana	point to spoon
duck	point to car
bye-bye	point to book
book	point to bunny
	push toy
	shake rattle
	move apple
	knock table
	move apple
	roll ball

*Exact content varied from family to family depending on infant's level of functioning.

APPENDIX D

LENGTH OF OBSERVATION IN EPOCHS AND REAL TIME OVER THE FOUR MAJOR OBSERVATION PERIODS

	Pre-training		End of Trn		3mths		6mths	
Dyad	*Epochs	**Time	Epochs	Time	Epochs	Time	Epochs	Time
01	81	13.5	130	21.7	84	14.0	93	15.5
02	93	15.5	144	24.0	104	17.3	132	22.0
03	72	12.0	84	14.0	88	14.7	116	19.3
04	96	16.0	84	14.0	96	16.0	84	14.0
05	128	21.3	94	15.7	144	24.0	120	20.0
06	127	21.2	132	22.0	132	22.0	99	16.5

*Epoch size=10 seconds.
**Time is reported in minutes.

APPENDIX E

MOTHER-CHILD INTERACTION: FREQUENCY OF BEHAVIOURS

(Scores are reported as proportion of possible total frequency).

A. INFANT BEHAVIOURS

	DYAD	Pre-Trn	End of Trn	3mths	6mths
01: Positive mother-directed activities	01	.309	.238	.202	.280
	02	.247	.208	.250	.250
	03	.250	.475	.136	.233
	04	.229	.381	.115	.226
	05	.094	.213	.083	.175
	06	.244	.364	.273	.263
02: Going from place to place	01	.000	.000	.060	.032
	02	.000	.000	.000	.091
	03	.000	.038	.080	.121
	04	.021	.000	.063	.000
	05	.000	.000	.000	.000
	06	.016	.000	.000	.000
03: Play with materials	01	.136	.185	.214	.183
	02	.226	.451	.365	.159
	03	.083	.200	.170	.095
	04	.281	.000	.208	.000
	05	.332	.255	.403	.117
	06	.063	.053	.068	.162

	DYAD	Pre-Trn	End of Trn	3mths	6mths
04: Negative Expression	01	.000	.000	.012	.032
	02	.000	.000	.000	.000
	03	.000	.013	.102	.095
	04	.188	.012	.021	.012
	05	.016	.000	.000	.000
	06	.000	.061	.023	.000
05: Eating	01	.025	.108	.012	.022
	02	.323	.139	.231	.121
	03	.125	.038	.045	.069
	04	.375	.119	.396	.083
	05	.203	.255	.306	.058
	06	.079	.053	.091	.091
06: Interacting with people	01	.025	.008	.000	.022
	02	.022	.063	.019	.038
	03	.167	.000	.034	.000
	04	.000	.155	.000	.000
	05	.008	.021	.000	.000
	06	.079	.068	.000	.000
07: Expressive Physical	01	.000	.038	.024	.140
	02	.011	.056	.087	.068
	03	.000	.025	.000	.043
	04	.083	.119	.083	.167
	05	.016	.011	.063	.033
	06	.016	.030	.083	.000
08: Vocalization	01	.062	.100	.155	.194
	02	.086	.174	.173	.258
	03	.139	.200	.091	.241
	04	.188	.190	.083	.262
	05	.227	.074	.167	.225
	06	.087	.136	.106	.212

B. MOTHER BEHAVIOURS

	DYAD	Pre-Trn	End of Trn	3mths	6mths
11: Attending Infant's Physical needs	01	.074	.092	.024	.075
	02	.505	.254	.442	.076
	03	.111	.075	.045	.095
	04	.521	.357	.458	.167
	05	.328	.468	.458	.067
	06	.102	.061	.136	.061
12: Restricting Infant's Activities	01	.074	.131	.024	.118
	02	.065	.042	.038	.068
	03	.014	.125	.114	.078
	04	.063	.024	.052	.012
	05	.039	.053	.014	.000
	06	.016	.045	.068	.020
13: Physical contact with Infant	01	.296	.254	.083	.161
	02	.667	.174	.500	.167
	03	.306	.288	.261	.078
	04	.427	.298	.375	.143
	05	.609	.500	.569	.092
	06	.205	.288	.394	.216
14: Stimulating Infant with Materials	01	.123	.192	.131	.140
	02	.098	.104	.183	.212
	03	.014	.188	.170	.034
	04	.104	.036	.240	.036
	05	.070	.032	.035	.142
	06	.110	.045	.045	.152
15: Looking at Infant	01	.037	.054	.012	.011
	02	.000	.000	.000	.015
	03	.083	.075	.080	.129
	04	.063	.012	.000	.071
	05	.500	.096	.521	.133
	06	.189	.106	.114	.051

	DYAD	Pre-Trn	End of Trn	3mths	6mths
16: Positive emotion Toward Infant	01	.370	.238	.369	.355
	02	.086	.271	.250	.364
	03	.111	.175	.114	.052
	04	.490	.369	.292	.298
	05	.023	.138	.014	.058
	06	.126	.144	.235	.313
17: Verbal Stimulation	01	.667	.500	.155	.591
	02	.652	.576	.558	.576
	03	.444	.638	.568	.371
	04	.656	.750	.615	.538
	05	.125	.457	.208	.258
	06	.409	.614	.568	.384
18: Coming and Going	01	.025	.008	.000	.000
	02	.032	.063	.000	.061
	03	.125	.063	.023	.172
	04	.042	.083	.010	.024
	05	.039	.021	.056	.058
	06	.031	.061	.038	.000
19: Gesture	01	.062	.069	.095	.172
	02	.011	.000	.019	.076
	03	.000	.025	.000	.009
	04	.042	.024	.042	.012
	05	.000	.000	.000	.025
	06	.000	.030	.023	.051

APPENDIX F

INTER-OBSERVER AGREEMENTS*

OCTOBER/NOVEMBER:

FAMILY 02

Infant behaviours	.79	.64	.67	.50			MEAN=.65
Mother behaviours	.83	.74	.59	.62			MEAN=.70

# of Sessions=4

FAMILY 03

Infant behaviours	.53	.75	.50	.72	.41	.57	MEAN=.58
Mother behaviours	.79	.57	.63	.49	.64	.35	MEAN=.58

# of Sessions=6

FAMILY 05

Infant behaviours	.92	.57	.83	.64	.52	.39	
	.59	.91	.67	.94			MEAN=.70
Mother behaviours	.85	.71	.93	.83	.55	.63	
	.76	.60	.86	1.00			MEAN=.77

# of Sessions=10

JANUARY/FEBRUARY

FAMILY 01 (JANUARY)

Infant behaviours	.50	.67	.75	.54	.93	.82	.58	MEAN=.68
Mother behaviours	.91	.71	.59	.60	.73	.90	.72	MEAN=.74

# of Sessions=7

FAMILY 01 (FEBRUARY)

Infant behaviours	.82	.60	.69	.93	.88	.47	.38	MEAN=.68
Mother behaviours	.80	.93	.72	.85	.67	.72	.94	MEAN=.80

# of Sessions=7

FAMILY 02

Infant behaviours	.81	.53	.69	1.00	.81	.89	MEAN=.79
Mother behaviours	.89	.73	.69	1.00	.67	***	MEAN=.79

# of Sessions=6 (*** only 1 behaviour recorded)

FAMILY 05

Infant behaviours	.90	.83	.86	1.00	.80	.85	
	1.00	.86	.93	.84	.88	.89	MEAN=.90
Mother behaviours	.91	.97	.97	1.00	1.00	.61	
	.55	.69	.79	.86	1.00	.84	MEAN=.85

# of Sessions=12

FAMILY 06

Infant behaviours	.73	.67	.67	.53	.71	.30	
	.33	.22	.56	.44	.60		MEAN=.52
Mother behaviours	.68	.50	.81	.74	.65	.69	
	.64	.64	.58	.56	.58		MEAN=.64

# of Sessions=11

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* Inter-observer agreement was defined as:

$$\frac{\#\text{ of agreements}}{\#\text{ of agreements} + \#\text{ of disagreements}}.$$

APPENDIX G

H.O.M.E. SCORES OVER THREE ASSESSMENTS

ASSESSMENT 1

	SUB-SCALES						
INFANT	I	II	III	IV	V	VI	TOTAL
01	11	7	6	9	6	5	44
02	11	8	6	9	6	5	45
03	8	7	6	8	3	1	33
04	9	8	5	6	6	3	37
05	8	6	5	2	1	1	23
06	5	6	6	6	4	1	28
Mean	8.67	7.00	5.67	6.67	4.33	2.67	35

ASSESSMENT 2

	SUB-SCALES						
INFANT	I	II	III	IV	V	VI	TOTAL
01	11	7	6	9	6	5	44
02	11	8	6	9	6	5	45
03	10	6	4	7	5	1	33
04	11	8	3	9	6	3	40
05	4	6	4	2	0	2	18
06	10	6	6	7	6	2	37
Mean	9.50	6.83	4.83	7.17	4.83	3.00	36.17

ASSESSMENT 3

	SUB-SCALES						
INFANT	I	II	III	IV	V	VI	TOTAL
01	11	7	6	9	6	5	44
02	11	8	6	9	6	5	45
03	11	7	6	9	6	1	40
04	11	7	6	9	6	5	44
05	7	5	4	8	5	0	29
06	9	6	5	9	6	2	37
Mean	10.00	6.67	5.50	8.83	5.83	3.00	39.83

APPENDIX H

H.O.M.E. INVENTORY

Child's Name ______________________ Date of Interview ____________

Child's Birthdate ______________________ Interviewer ____________

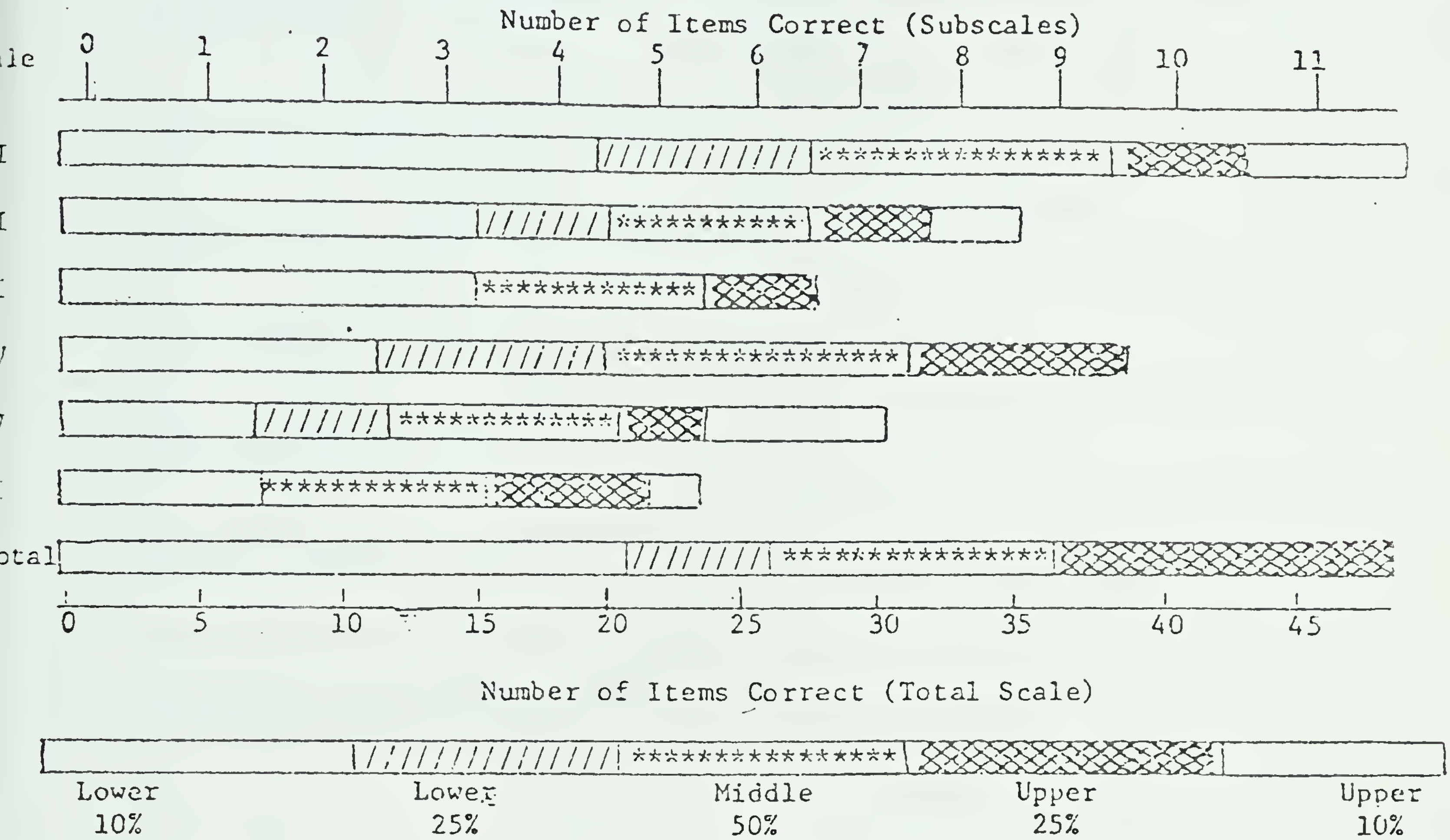
Relationship of person interviewed to child ______________________ Place of Interview ____________

Family Composition ____
(Indicate persons living in household, including sex and age of children)

Persons present in home at time of interview ______________________

Comments ____

____



Subscale	Raw Score	Percentile Band
I Emotional and Verbal Responsivity of Mother		
II Avoidance of Restriction and Punishment		
III Organization of the Physical and Temporal Environment		
IV Provision of Appropriate Play Materials		
V Maternal Involvement with the Child		
VI Opportunities for Variety in Daily Stimulation		
Total		

INVENTORY (Birth to Three)

I. EMOTIONAL AND VERBAL RESPONSIVITY OF MOTHER	YES	NO
1. Mother spontaneously vocalizes to child at least twice during visit (excluding scolding)		
2. Mother responds to child's vocalizations with a verbal response.		
3. Mother tells child the name of some object during visit or says name of person or object in a "teaching" style.		
4. Mother's speech is distinct, clear, and audible.		
5. Mother initiates verbal interchanges with observer--asks questions, makes spontaneous comments.		
6. Mother expresses ideas freely and easily and uses statements of appropriate length for conversation (e.g., gives more than brief answers).		
*7. Mother permits child occasionally to engage in "messy" types of play.		
8. Mother spontaneously praises child's qualities or behavior twice during visit.		
9. When speaking of or to child, mother's voice conveys positive feeling.		
10. Mother caresses or kisses child at least once during visit.		
11. Mother shows some positive emotional responses to praise of child offered by visitor.		
SUBSCORE		

II. AVOIDANCE OF RESTRICTION AND PUNISHMENT		
12. Mother does not shout at child during visit.		
13. Mother doesn't express overt annoyance with or hostility toward child.		

(* Items from Categories I and II which may require direct questions.)

14. Mother neither slaps nor spanks child during visit.		
*15. Mother reports that no more than one instance of physical punishment occurred during the past week.		
16. Mother does not scold or derogate child during visit.		
17. Mother does not interfere with child's actions or restrict child's movements more than three times during visit.		
18. At least ten books are present and visible.		
*19. Family has a pet.		
SUBSCORE		

III. ORGANIZATION OF PHYSICAL AND TEMPORAL ENVIRONMENT		
20. When mother is away, care is provided by one of three regular substitutes.		
21. Someone takes child into grocery store at least once a week.		
22. Child gets out of house at least four times a week.		
23. Child is taken regularly to doctor's office or clinic.		
*24. Child has a special place in which to keep his toys and "treasures."		
25. Child's play environment appears safe and free of hazards.		
SUBSCORE		

IV. PROVISION OF APPROPRIATE PLAY MATERIALS		
26. Child has some muscle activity toys or equipment.		
27. Child has push or pull toy.		
28. Child has stroller or walker, kiddie car, scooter, or tricycle.		

	YES	NO
29. Mother provides toys or interesting activities for child during interview.		
30. Provides learning equipment appropriate to age--cuddly toy or role-playing toys.		
31. Provides learning equipment appropriate to age--mobile, table and chairs, high chair, play pen.		
32. Provides eye-hand coordination toys--items to go in and out of receptacle, fit together toys, beads.		
33. Provides eye-hand coordination toys that permit combinations--stacking or nesting toys, blocks or building toys.		
34. Provides toys for literature music.		
SUBSCORE		

V. MATERNAL INVOLVEMENT WITH CHILD		
35. Mother tends to keep child within visual range and to look at him often.		
36. Mother "talks" to child while doing her work.		
37. Mother consciously encourages developmental advances.		
38. Mother invests "maturing" toys with value via her attention.		
39. Mother structures child's play periods.		
40. Mother provides toys that challenge child to develop new skills.		
SUBSCORE		

VI. OPPORTUNITIES FOR VARIETY IN DAILY STIMULATION		
41. Father provides some caretaking every day.		
42. Mother reads stories at least three times weekly.		
43. Child eats at least one meal per day with mother & father.		
44. Family visits or receives visits from relatives.		
45. Child has three or more books of his own.		
SUBSCORE		